



Australian Government



Australian  
Space Agency

# State of Space Report

A report by the Australian Government  
Space Coordination Committee

1 July 2020 – 30 June 2021

[space.gov.au](http://space.gov.au)



© Commonwealth of Australia 2022

Ownership of intellectual property rights

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.



**Creative Commons licence**

The material in this publication is licensed under a Creative Commons Attribution - 4.0 International licence, with the exception of:

- the Commonwealth Coat of Arms
- any third party material
- any trademarks, and
- any images or photographs.

The terms under which the Coat of Arms can be used are detailed on the following website:  
[pmc.gov.au/government/its-honour](http://pmc.gov.au/government/its-honour)

Wherever a third party holds copyright in this material, the copyright remains with that party. Their permission may be required to use the material. Please contact them directly.

More information on this CC BY license is set out at the Creative Commons Website. Enquiries about this publication can be sent to:

Australian Space Agency  
Level 3, McEwin Building  
Lot Fourteen, North Terrace  
Adelaide SA 5001  
Phone: 1800 497 182 (within Australia) / +61 2 6276 1166  
Email: [enquiries@space.gov.au](mailto:enquiries@space.gov.au)  
[space.gov.au](http://space.gov.au)

#### *Attribution*

Use of all or part of this publication must include the following attribution:  
© Commonwealth of Australia 2022, published by the Australian Space Agency.

#### *Citation*

Australian Space Agency (2022), State of Space Report 2020-2021  
Canberra: Commonwealth of Australia, April; available at on the [Australian Space Agency](http://www.space.gov.au) website.

#### *Disclaimer*

By accessing or using this publication, you agree to the following:  
This publication is not legal or professional advice. Persons rely upon this publication entirely at their own risk and must take responsibility for assessing the relevance and accuracy of the information in relation to their particular circumstances.



# Acknowledgements

The Australian Space Agency would like to thank the following Commonwealth agencies and organisations for their contribution in producing this report:

- Attorney-General's Department
- Australian Antarctic Division of the Department of Agriculture, Water and the Environment
- Australian Communications and Media Authority
- Australian Trade and Investment Commission (Austrade)
- Bureau of Meteorology
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Department of Defence
- Department of Foreign Affairs and Trade
- Department of Finance
- Department of Home Affairs
- Department of Industry, Science, Energy and Resources
- Department of Infrastructure, Transport, Regional Development and Communications
- Department of Prime Minister and Cabinet
- Geoscience Australia
- Treasury



# Contents

Foreword	5
Introduction	7
Australian Space Agency	9
Measuring Success	19
International	22
National	38
Responsible	73
Inspire	76
Appendix	90
References	97

## Foreword



As the new Head of the Australian Space Agency, signing on in January 2021, it is gratifying that the completion of the Agency's third year of operations has seen the realisation of a number of major projects, despite challenging conditions.

Since day one we have been committed to our vision to transform and grow Australia's space sector and, at the completion of Phase Two of the Australian Civil Space Strategy, the momentum continues to grow.

The Australian Government has invested more than \$700 million in the industry to grow Australia's economy, inspire and improve the lives of all Australians. The sector continues to build and move forward – jobs are being created, private investment is growing, new technologies are emerging, and our domestic capabilities are building. Australia is definitely on the global map when it comes to space.

In the reporting year, we've opened Australia's first publicly viewable Mission Control Centre; a national facility for small-to-medium enterprises and researchers to control satellites and space missions. We've given significant backing to Australian industry through a series of grants as part of our \$150 million Moon to Mars partnership with NASA. We also granted our first Australian launch facility licence, and launched the first of our planned series of technical roadmaps.

We continued to open doors internationally, strengthening our relationship with Japan by supporting the Japan Aerospace Exploration Agency's Hayabusa2 return mission, and re-invigorating our civil space cooperation agreement with India through the update of the 2012 *Memorandum of Understanding Concerning Cooperation in Civil Space Science, Technology and Education* that will further unlock space collaboration between the two countries. We also established the Australia-UK Space Bridge Arrangement to make the sector stronger through new trade, technology and investment opportunities.

*“It's not every day you have the opportunity to lead the space program for a nation. It's an immense honour and privilege to serve Australia in this capacity as Agency Head.”*



Our vision to inspire is being realised. In just over eight months, with the invaluable assistance of Questacon – the National Science and Technology Centre, we built and opened our Australian Space Discovery Centre to the public. This world-class centre is an immersive, hands on experience, showcasing Australia’s current and future role in space, while also inspiring our next generation to consider space careers.

Space is well and truly reignited in Australia. I cannot wait to see what the Australian Space Agency, and importantly the space sector, accomplishes in the year ahead.

Enrico Palermo

April 2022



# Introduction

The 2020-21 financial year has been a period of transition for the Australian Space Agency, moving from Phase Two to Phase Three of the *Australian Civil Space Strategy 2019-2028* (refer to Figure 1).

After capably leading the Agency through its initial start-up and growth phases, Dr Megan Clark AC completed her time as the Head of the Agency in December 2020 and moved to a new role as the Chair of the Advisory Board. In January 2021, Mr Enrico Palermo commenced as the Agency's new Head, having previously served as the Chief Operating Officer of Virgin Galactic.

The Australian Space Agency has continued to make rapid strides, opening doors internationally that have brought new opportunities to the Australian space sector. In October 2020, the Agency joined seven other nations in signing the Artemis Accords, which helps Australia advance space as a partner with NASA and international counterparts on the Artemis mission to the Moon and beyond to Mars. The Agency demonstrated its commitment to being Australia's front door for international cooperation in space by supporting of the recovery of JAXA's Hayabusa2 sample return capsule in December 2020. February 2021 saw the announcement of the Australia-UK Space Bridge Framework Arrangement, which enhances cooperation between the Australian and UK space agencies, as well as trade and investment agencies to accelerate the growth of both space sectors.

With the ongoing COVID-19 pandemic, the space sector has shown itself to be resilient and an important part of the nation's economic recovery. The Agency has continued to work closely with the space sector to identify challenges, concerns and issues specific to the industry. In addition to oversight of its existing Space Infrastructure Fund and International Space Initiative programs, the Agency commenced the award of grants under the Supply Chain and Demonstrator programs of its Moon to Mars initiative. It has also contributed to the Australian Government's Modern Manufacturing Strategy, in which space is identified as a priority sector.

Important progress towards the Agency's 10 year Civil Space Strategy was achieved with the grant of Australia's first launch facility licence and the release of the first Civil Space Priority Area roadmap, focussed on Communications Technologies and Services. To enable the Agency's progress in meeting the measures of success for space industry growth established by Government, the *Economic snapshot of the Australian space sector: 2016-17 to 2018-19* report was released in February 2021. This report provides a baseline against which future progress can be consistently measured.

The Agency also made a significant advance in the 'Inspire' pillar of the Civil Space Strategy with the official public opening of the Australian Space Discovery Centre in May 2021. The Centre, which is co-located with Agency headquarters in Adelaide, aims to inspire the Australian community and the next generation of the space workforce through stories of opportunity, curiosity and technology.

The Government departments and agencies that make up the Space Coordination Committee (SCC) are increasing their space-related activities in response to Government investment and new opportunities in the space sector. These activities are categorised in this report under the four Strategic Space Pillars and National Civil Space Priority Areas of the *Australian Civil Space Strategy 2019-2020*. A selection of case studies highlighting the activities of SCC member departments and agencies is also included.

# AUSTRALIAN CIVIL SPACE STRATEGY 2019-2028: IMPLEMENTATION

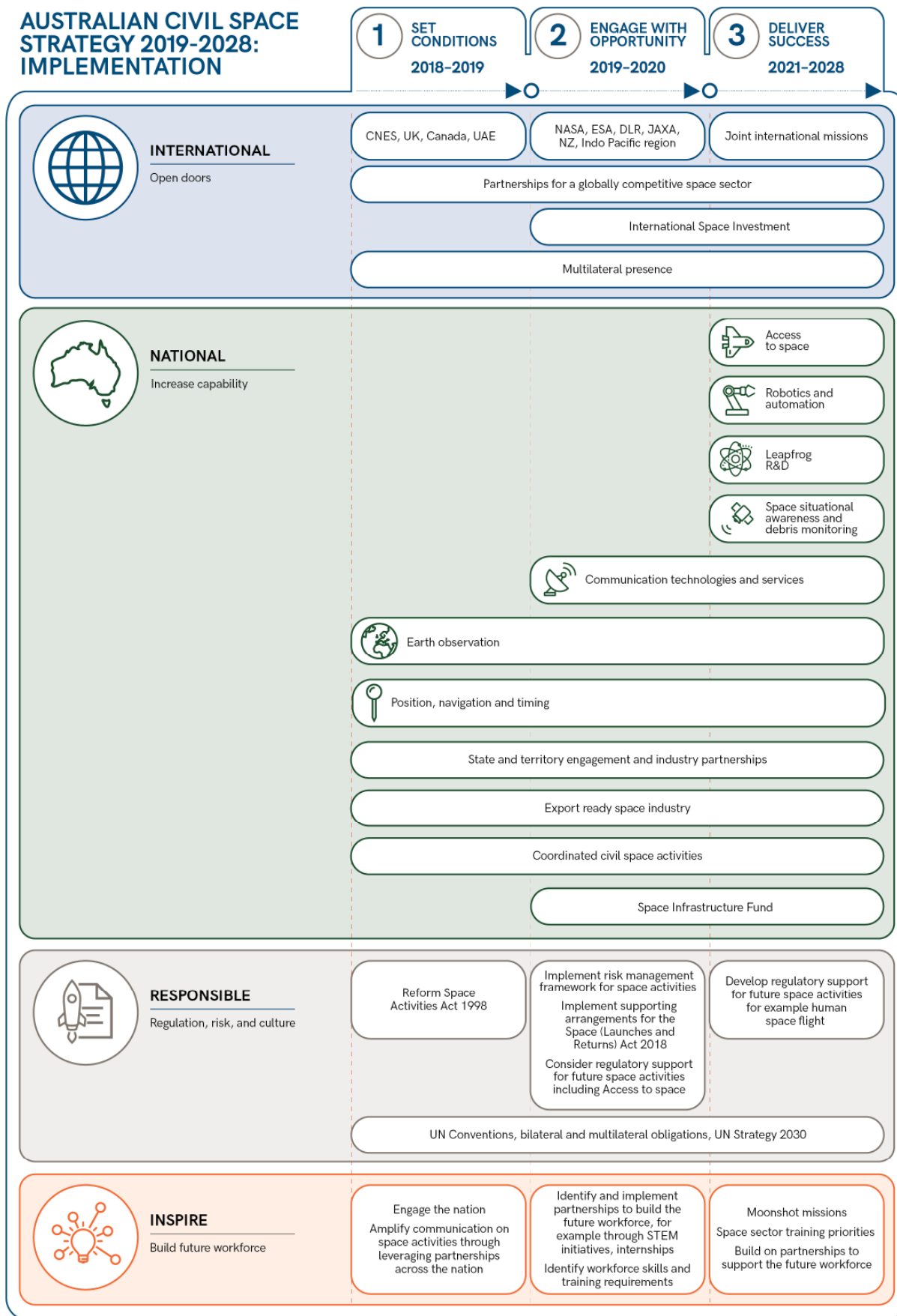


Figure 1 – Summary of the Australian Civil Space Strategy



# Australian Space Agency

*The Agency's purpose is to transform and grow a globally respected Australian space industry that lifts the broader economy, inspires and improves the lives of Australians, underpinned by strong international and national engagement.*

## About the Agency

### Purpose and responsibilities

The Agency is a non-statutory, whole-of-government entity located within the Department of Industry, Science, Energy and Resources (DISER) as a separately branded function. Established on 1 July 2018, the Agency is the front door for Australia's international engagement on civil space and operates as the national priority-setting mechanism for the civil space sector.

The Agency's role is to provide whole-of-government coordination on civil space matters. It is the primary source of advice to the Australian Government on civil space policy. Under this broad mandate, the Agency has six primary responsibilities:

- Providing national policy and strategic advice on the civil space sector.
- Coordinating Australia's domestic civil space sector activities.
- Supporting the growth of Australia's space industry and the use of space across the broader economy.
- Leading international civil space engagement.
- Administering space activities legislation and delivering on our international obligations.
- Inspiring the Australian community and the next generation of space entrepreneurs.



*Figure 2 – Inspiring the Australian community. Staff at the Australian Space Discovery Centre on public opening day, 5 May 2021*

## Achievements

The Agency's third year of operations has seen the completion of a number of major projects, despite challenging conditions. New funding projects to promote the growth of the Australian space sector have been

initiated and significant new international partnerships have been established to further open doors for Australian companies to enter global supply chains. A summary of achievements are outlined in *Figure 4*.

## International

The Agency's most significant international achievement was becoming a signatory to the US-led Artemis Accords during the 71st International Astronautical Congress (IAC) in October 2020. On 14 October 2020, Australia became one of the founding eight signatories to the Artemis Accords, which aim to increase the safety of operations, reduce uncertainty, and promote the sustainable and beneficial use of space.

In other initiatives with the United States, the Agency was granted permission to negotiate a Space Framework Agreement in June 2020, and a mandate to negotiate a Technology Safeguards Agreement (TSA) in June 2021. A TSA would allow for the launch and recovery of US technology from Australian soil under strict protocols and support access to space from Australia.

On 7 July 2020, the Agency and the Japan Aerospace Exploration Agency (JAXA) signed a *Memorandum of Cooperation (MOC) on Space Cooperation for Peaceful Purposes*, which allows for expanded cooperation between the two space agencies. A highly successful of JAXA-Agency cooperation was Australia's involvement in the recovery of the asteroid sample return capsule from Japan's Hayabusa 2 mission. The Agency led a multi-agency cooperative effort to bring JAXA and NASA personnel into Australia for the recovery operation, while meeting all COVID, border security and quarantine regulations. On 6 December 2020, JAXA successfully recovered the Hayabusa2 sample return capsule in the Woomera Prohibited Area, after it travelled over 5 billion kilometres to return to Earth.

Also notable was the signing, on 23 February 2021, of the UK-Australia Space Bridge Framework Arrangement. Connecting Austrade and the Australian Space Agency with the UK Space Agency (UKSA) and the UK Department for International Trade (UK DIT), the Space Bridge will bring benefits to our space industries, facilitating new trade and investment opportunities and the exchange of knowledge and ideas.

On 17 February 2021, Australia-India space cooperation also moved forward with the signing of an update of the 2012 *Memorandum of Understanding with India Concerning Cooperation in Civil Space Science, Technology and Education*.

## National

The first publication in the Agency's Technology Roadmaps series, the *Communications Technologies and Services 2021-2030* roadmap was released on 22 December 2020. It provides the strategic direction to capture opportunities to grow the industry over the coming decade.

After the bushfire season of 2019-2020, the Agency led the Bushfire Earth Observation Taskforce. Its report was considered by the Royal Commission into National Natural Disaster Arrangements in mid-2020 and released by the Agency in December 2020 after an in-person hearing.

In January 2021, the Agency led a cross-portfolio submission to the House of Representatives Standing Committee on Industry, Innovation, Science and Resources for the *Inquiry into developing Australia's space industry*, and conducted ongoing evaluation and analysis of submissions to the enquiry.

The Agency released the *Economic Snapshot of the Australian Space Sector: 2016-17 to 2018-19* report, in February 2021, as the baseline against which future changes in the sector performance will be measured. The report provides the first snapshot of the sector's progress towards the Australian Government's goals for the space sector.

May 2021 saw the release of Phase 1 of the Space Industry Skills Gap Analysis report undertaken by the SmartSat Cooperative Research Centre (CRC), supported by the Agency as an initial step to understanding the skills needs of the national space workforce.

Over the past year, the Agency provided over \$17 million in grants, an important step in stimulating the space sector and growing the economy.

The Agency's \$150 million Moon to Mars (M2M) is designed to benefit local space businesses and researchers in the short term by building capability, while also helping to secure Australia's economic recovery from the COVID-19 pandemic, creating more high-tech jobs and strengthening industry in the medium to long term. In 2020-2021, the Agency opened its first two M2M grant mechanisms – the Supply Chain and Demonstrator programs. Under these two ongoing programs a total of 24 Australian businesses received funding in the reporting period.

As part of the 2020-2021 Federal Budget, the Government allocated \$1.5 billion for the Modern Manufacturing Strategy (MMS), with Space identified as one of six National Manufacturing Priorities (NMP). The Agency worked closely with DISER, which has been charged with the delivery of the Modern Manufacturing Initiative to promote awareness of the MMS within the space sector and support the development of the Space National Manufacturing Roadmap.

The Space Infrastructure Fund (SIF) and International Space Initiative (ISI) funding programs have been proceeding on track. Two facilities funded by the SIF, the Mission Control Centre in Adelaide and the Australian Space Data Analysis Facility in Perth, officially opened in 2021. In June 2021, a \$2.5 million Space Payload Qualification Facilities SIF grant was awarded to the Australian National University.

## Responsible

The Office of the Space Regulator was established within the Agency in September 2020 to oversee the implementation of regulations associated with Australian civil space activities. In May 2021, the Agency received an additional \$13.3 million in the 2021 Federal Budget including funds to increase its capacity to deliver regulatory services.

March 2021 saw an important milestone for the Australian space sector, with the Minister for Industry, Science and Technology granting Australia's first launch facility licence to Southern Launch for its Koonibba Test Range, in western South Australia.

The Agency undertook consultation with industry on partial cost recovery for the assessment of applications made under the *Space (Launches and Returns) Act 2018* was undertaken. After the consideration of industry input, the Australian Government announced on 1 July 2021 that the introduction of partial cost recovery will be delayed for a further 12 months until 1 July 2022. This deferral will encourage launch activity and continued investment and growth in the broader space sector.

## Inspire

The centrepiece of the Agency's Inspire pillar, the Australian Space Discovery Centre (ASDC), was officially opened by the Prime Minister on 31 March 2021, and opened to the public on 5 May 2021. The Centre had welcomed almost 5,000 visitors by June 30, with a total of 12,000 tickets booked for future sessions.

In July 2020, the Agency signed an agreement with NASA to take part in its Global Learning and Observations to Benefit the Environment (GLOBE) program, which is delivered in Australia by CSIRO.

Across the year, a number of sponsorships to support space and STEM engagement programs for school and undergraduate students were initiated.

A new Agency ‘mascot’, Purra the space kangaroo, was flown on the International Space Station between November 2020 and May 2021. Purra takes his name from a sky story told by the Boorong People of Victoria, which is one of the Indigenous constellations depicted on the Australian Space Agency logo.

For the period 1 July 2020 – 30 June 2021, an analysis of coverage found a total of 3,424 mentions. This reached a cumulative potential of 46,591,272.

The Agency also completed its suite of social media channels with the launch of its Instagram channel on 24 March 2021.

## Governance

The Agency’s governance structure is centred on the roles of the Agency Head, Deputy Head and the Advisory Board. The Agency Head is appointed by, is accountable and reports to, the Minister for Industry, Science and Technology. The Agency Head is responsible for overall governance and performance, management, policy leadership and strategic direction of the Agency. The Deputy Head has oversight of strategy, policy and day-to-day operations of the Agency, and supports the Agency Head in monitoring the performance of the Agency.



*Figure 3 – The Agency Advisory Board*

The Agency Advisory Board is a non-statutory, independent, skills-based panel that provides advice to the Agency Head. It is not a decision-making body, and has no governing legislation. Appointments to the Advisory Board are for a period of up to three years. The Advisory Board met on 3 September and 1 December 2020, and on 3 March 2021.

In November 2020, Advisory Board member former astronaut and retired US Air Force Colonel Pam Melroy resigned. She was appointed to the position of NASA Deputy Administrator in June 2021. An appointment process is underway to fill the vacancy created on the Advisory Board.

The Agency works in partnership with government agencies involved in space activities to ensure a whole-of-government approach is taken in respect of civil space activities. To meet its responsibilities, the Agency also works with a wide range of stakeholders, including industry, Australian Government departments, State and Territory Governments, researchers and international organisations.

Other governance engagement mechanisms include:

- 1. Australian Government Space Coordination Committee (SCC).** The Agency chairs the SCC, the purpose of which is to coordinate and discuss whole-of-government policy settings on civil space activities. It is open to all relevant Australian Government departments and agencies and functions as an inter-

departmental committee comprising senior official representation from across government. The SCC aims to meet quarterly, providing consultation and information sharing between jurisdictions and agencies. Meetings were held on 23 September and 9 December 2020, and on 17 March and 9 June 2021

- 2. Space Industry Leaders Forum (the Forum).** The Forum is the primary mechanism for engagement and coordination with the Australian space industry. Its purpose is to assist the Agency with the business and technological aspects of the space industry and to provide input into national civil space strategy and policy. The Forum includes representatives from industry, academia, relevant industry associations and other non-government space organisations within Australia. Science, Technology, Engineering and Mathematics (STEM) engagement is a high priority for the Industry Forum, which met on 29 September 2020 and 30 March 2021, in conjunction with the Australian Space Forum and the opening of the Australian Space Discovery Centre.
- 3. State and Territory Space Coordination (STSC).** The states and territories play a key role in the national space enterprise. The Agency engages closely with states and territories to support national space policy and strategy, coordinate activities and provide one voice for Australia's civil space sector. The STSC aims to provide engagement for jurisdictions to support national space policy and strategy and provide one voice for Australia's civil space sector. These meetings help to regularly connect with our state and territory counterparts, keep abreast of relevant space activities in each jurisdiction and coordinate our international outreach. STSC Meetings are intended to occur quarterly and were held on 2 September and 2 December 2020, and 10 March and 16 June 2021.





Figure 4 – Australian Space Agency Accomplishments 2018-21



## Civil Space Coordination

A number of Australian Government agencies engage in a variety of space-related activities to support Australia's strategic, economic and social objectives. Ensuring that the operating environment for these activities is conducive to innovation, combined with coordination and international cooperation, are the key factors to maintaining and strengthening the space capabilities on which Australia relies for its national security and civil well-being.

The Agency is the central point of contact and coordination for the Australian Government's involvement in civil space. This role includes chairing the SCC. The SCC membership is comprised of Australian Government departments and agencies with an interest in civil space:

- **Attorney-General's Department (AGD)**: The Office of International Law within AGD provides legal advice to government on international space law, ensuring that Australia's engagement in the space domain is consistent with Australia's international obligations.
- **Australian Antarctic Division (AAD)**: The Australian Antarctic Division of the Department of Agriculture, Water and the Environment (DAWE) oversees Antarctic, Sub-Antarctic and Southern Ocean science and technology. It leads, coordinates and delivers the Australian Antarctic Program (AAP), which includes space analogue research for space medicine and life sciences.
- **Australian Communications and Media Authority (ACMA)**: ACMA is responsible for the regulation of radio communications services, including the radiocommunications licencing of space-based communications systems in Australia and International Telecommunications Union (ITU) satellite filing coordination.
- **Australian Space Agency (the Agency)**: The Agency provides whole-of-government coordination of civil space matters and is the primary source of advice to the Australian Government on civil space policy.
- **Australian Trade and Investment Commission (Austrade)**: Austrade is the Australian Government's trade, investment and education promotion agency. It supports Australia's international space sector engagement.
- **Bureau of Meteorology (the Bureau)**: The Bureau is Australia's national weather, climate and water information agency. It relies on real time Earth observations from space and space weather observations to deliver forecasts, warnings, analyses and advice covering Australia's atmosphere, water, ocean and space environments.
- **Commonwealth Scientific and Industrial Research Organisation (CSIRO)**: CSIRO is Australia's national science agency, and is involved in space science and technology research and development, and Earth observation (EO) science and applications. It also manages and operates critical national and international space-related infrastructure.
- **Department of Defence (Defence)**: Defence is concerned with civil space activities that overlap with defence-related issues in space.
- **Department of Foreign Affairs and Trade (DFAT)**: DFAT is responsible for Australia's engagement on space-related international security issues.
- **Department of Home Affairs (Home Affairs)**: Home Affairs' diverse responsibilities contribute to making Australia more secure, prosperous and united. A range of Home Affairs responsibilities have touch-points with space issues, including critical infrastructure resilience policy.
- **Department of Industry, Science, Energy and Resources (DISER)**: DISER maintains a role in the development of the Australian space industry, particularly on identifying broader linkages between space and other industry sectors, such as defence and advanced manufacturing. DISER's International and Astronomy Branch (IAB) leads, coordinates and delivers on the Australian Government investments in radio and optical astronomy. The department also has an ex-officio position on the Agency's Advisory Board and maintains a policy capability on the development of Australia's space industry outside of the Agency, in Industry Growth Division.
- **Department of Infrastructure, Transport, Regional Development and Communications (DITRDC)**: DITRDC provides policy oversight of radiocommunications services and spectrum management (including satellite communication) in Australia. DITRDC's interests in civil space also include the application of satellite-enabled services for road, rail, maritime and aviation sectors. These activities are carried out by DITRDC and its transport portfolio agencies: the Australian Maritime Safety Authority (AMSA); the Civil Aviation Safety Authority (CASA) and Airservices Australia (Airservices).

- **Department of the Prime Minister and Cabinet (PM&C)**, the **Treasury** and the **Department of Finance**: These departments have observer status on the SCC. They assist its members in coordinating their activities across all areas of government.
- **Geoscience Australia (GA)**: GA is Australia's pre-eminent public sector geoscience organisation, and manages the nation's geographic and geological data. GA is responsible for Australia's fundamental national positioning infrastructure and services, and leads the Australian Government's operational monitoring of the land using satellite Earth observations.

Four working groups report to the SCC: The Australian Government Earth Observation from Space (EOS) Working Group (AGEOSWG); The Position, Navigation and Timing (PNT) Working Group; The Inter-Departmental Working Group on Space Law; and The National Security Space Inter-Departmental Committee. These working groups promote national coordination and planning and report to the SCC on relevant strategic priorities including coordinated advice on domestic and international policy, standards, and research.

The SCC provides contributions to the *State of Space* reports.

## Australian Space Agency Post-Commencement Evaluation

The Department of Industry, Science, Energy and Resources has undertaken a post-commencement evaluation of the Australian Space Agency (the Evaluation), in conjunction with an external provider. Many members of the governance committees of the Agency have been involved.

The scope of the Evaluation included the Agency's design, implementation, impact and outcomes, and lessons learned since its establishment in 2018. It also considered any data collection and reporting requirements that would aid in monitoring the Agency's performance and impact in subsequent years. In particular, the Evaluation assessed:

- The effectiveness, efficiency and appropriateness of current governance and operating arrangements, including the Agency's alignment with the department's other portfolio programs;
- Progress towards the Agency's objectives as outlined in its Charter, the Minister's Statement of Expectations and the Australian Civil Space Strategy 2019-2028; and
- Different operating models and their suitability to achieving the Agency's outcomes.

The outcomes of the post-commencement evaluation were also used to inform the department's operational review of the Agency which is required by the Agency's Charter to be conducted within four years of the Agency's establishment. The review provides advice to Government whether the Agency should remain within the department or transition to a statutory authority. It was completed in September 2021 and is currently considered Government. The Review is due to be completed by end August 2021.

## Policy

The Agency worked on several civil space policy areas during 2020-21, including participation in working groups relating to:

- How the space sector can support economic recovery post-COVID-19.
- Options for Australia for space tourism. The final report of a market analysis on the economic opportunities for space tourism was presented to the Agency in June 2021. Components of this report were shared with the Space Coordination Committee.
- Policy settings relating to space ground stations, including in regard to Critical Infrastructure reforms led by the Department of Home Affairs.
- Working with a range of agencies on appropriate arrangements to address US concerns in relation to the movement of sensitive technologies and goods used in Australia's civil launch activities. The Agency engaged the South

Australian Centre for Economic Studies on a review of Australia’s launch sector to understand current and planned launch activities, import and export destinations, and international obligations.

- Matters in the national security policy domain, working closely with a range of agencies including the Department of Defence, DFAT and the Department of Home Affairs.
- Linking the benefits of space technologies in boosting agricultural productivity, as part of the upcoming Ag2030 package.

In January 2021, the Agency led a submission to the House of Representatives Standing Committee on Industry, Innovation, Science and Resources for the inquiry into developing Australia’s space industry. The submission included input across the portfolio, and from the Department of Defence, DFAT and DITRDC. The Agency has undertaken ongoing tracking and analysis of submissions to the inquiry, and looks forward to the Committee tabling the report. It is expected that recommendations from the report will inform Government consideration of the statutory basis for the Agency

The Agency is supporting the Manufacturing Division within the department on the space priority area of the Modern Manufacturing Strategy. In February 2021 the Space National Manufacturing Priority road map was released, which set a plan for industry and government to work together towards a common vision in the space sector. Businesses with projects in the space sector became the first to be able to apply for grants under the \$1.3 billion Modern Manufacturing Initiative, with applications closing on 22 March 2021.

The Agency is undertaking Phase 2 of the Space Industry Skills Gap Analysis report, commissioned by the SmartSat Cooperative Research Centre (CRC) in partnership with the Agency. This will build on the [Phase 1](#) report that identified 319 specific skills as part of a three tiered hierarchical structure, and was subsequently used as the basis for a survey of 90 organisations across the sector. The Phase 2 study will undertake additional qualitative work to triangulate the results of the skills gap report to:

- Provide industry validation for the Australian Space Skills Taxonomy;
- Test the Skills Gap findings with the lived experience of space industry and training providers, and capture more qualitative information about skills needs pressure points; and
- Capture the views of stakeholders underrepresented in the analysis.

Working with DISER Analytical Insights Division, the Strategy and Policy team supported the development of the evaluation framework for the Agency. The framework supports the delivery of the post–commencement evaluation of the Agency (commenced in Quarter 2 2021), and the review of Agency operations.

## COVID-19 response and recovery

Across the reporting period, the Agency recorded no COVID-19 cases. Staff were supported to work from home, with staff wellbeing has been a priority. All requirements set by the Australian Government for COVID-19 were met. Social distancing and venue capacity requirements in South Australia made it necessary for the Agency to adopt a different mode of operation for the Australian Space Discovery Centre (ASDC) from that originally planned. Instead of casual walk-in access to the facility, visitors were required to pre-book for timed sessions with strictly limited numbers. The ASDC was able to open to the public on 5 May 2021 and operated without incident, with all sessions fully booked, for the remainder of the reporting period, welcoming almost 5,000 visitors to 30 June 2020.

Many international and national space events were cancelled, rescheduled or moved to a virtual format. This included: COSPAR 2020 moved from August 2020 to January 2021 and offered in a hybrid in-person/virtual format; the regional space conference, APRSAF-27 delayed 12 months from November 2020 to November 2021; and the Avalon Airshow, postponed from February 2021 to November 2021. The 2020 International Astronautical Congress (IAC) was held as a free global virtual program.

Within DISER, the Agency supported relevant COVID taskforces. The space sector has shown itself to be resilient. As Australia looks at economic recovery post-COVID, local space industry can be an important enabler of other vital Australian industries, including increasing manufacturing and digital capabilities.

To encourage launch activity and continued investment and growth in the broader space sector, on 30 June 2021 Government announced a further deferral of the introduction of partial cost recovery for applications submitted under the Space (Launches and Returns) Act 2018. Under the deferral of fees, businesses can continue to apply for space activities such as launches without incurring an application fee. These settings will remain in place until 1 July 2022.

# Measuring Success

*Activities under the four Strategic Space Pillars will grow and transform Australia's space industry and position Australia to triple the space sector's revenue to over \$12 billion per annum and create an additional 20,000 jobs by 2030.*

The Australian Government's *Advancing Space: Australian Civil Space Strategy 2019-2028* (the Strategy) set overarching goals for the Agency: to triple the size of the Australian space sector to AU\$12 billion and create up to 20,000 new direct and indirect space jobs by 2030<sup>1</sup>. Released in April 2019, the Strategy also set targets against key indicators – sector growth at an annual rate of 8.5 percent, and for inbound investment<sup>2</sup> to reach \$1 billion<sup>3</sup> by 2025.

In February 2021, the Agency released the [Economic Snapshot of the Australian Space Sector: 2016-17 to 2018-19](#) report, as the baseline against which future changes in the sector performance will be measured. The report establishes the 2016-17 financial year (FY17) as the starting point of the sector's size and characteristics, and tracks its growth to financial year 2018-19 (FY19), providing the first snapshot of the sector's progress towards the Australian Government's goals<sup>4</sup>. This initial report details a repeatable methodology that allows consistent tracking of the sector over time. This methodology will inform a series of future economic snapshots approximately every two years, to help understand changes and identify opportunities in the space sector, as well as inform the Agency's future strategic direction.

The time period covered by the Economic Snapshot captures the Agency's first year of operations and Phase One of the Strategy. The Agency was established on 1 July 2018. While it achieved a great deal in its first year<sup>5</sup>, at the end of FY19 the Agency was just moving from Phase One of the Strategy – *Setting conditions for growth (2018-19)* into Phase Two – *Engaging with opportunity (2019-2021)* of the Australian Government's plan to grow Australia's space sector.

The period covered by this report, therefore, ends before significant Australian Government investments targeted to transform Australia's space industry began to reach the sector. Given the time period covered, the figures in this report do not reflect impacts of COVID-19. *Table 1* provides a summary of the sector's progress against key indicators for the FY17 to FY19 period.

---

<sup>1</sup> [Australian Space Agency \(2019\), Advancing Space: Australian Civil Space Strategy 2019-2028](#)

<sup>2</sup> Inbound investment includes investments by industry, international space agencies and private foundations. It does not include investments from Australian governments or universities.

<sup>3</sup> Monetary values are in Australian dollars (AUD) throughout this report unless otherwise noted.

<sup>4</sup> The economic baseline for the sector is set in 2016-17, the financial year prior to the Agency's announcement. The 2018-19 snapshot measures the change in the sector from the baseline, up to the end of the Agency's first year of operations.

<sup>5</sup> Australian Space Agency (2019), Australian Space Agency 1 year on: A message from Head, Dr Megan Clark AC – available on [website](#)

Table 1 – Australian space sector performance – Snapshot of the key indicators

Indicator	FY17	FY19	2030 Target
Revenue	\$4.3 billion	\$4.6 billion	\$12 billion
		+2.9% average annual growth	+8.5% annual growth
Jobs	10,430 direct jobs	11,560 direct jobs +5.4% average annual growth	30,000 direct & indirect jobs (which includes 20,000 new jobs)
Total Investment		\$2.02 billion (at September 2020)	N/A
Inbound Investment		\$774.6 million	\$1 billion (2025 Target)

Changes in the sector summarised in the table above show that the sector is making positive progress towards the Australian Government’s goals to triple the size of the sector by 2030. The two years to FY19 saw:

- An 11.3 per cent increase in the number of organisations operating in the Australian space sector from FY17 to FY19.
- Increased employment with over 1,100 direct space jobs created between FY17 and FY19.
- Steady increase in space sector revenue, from \$4.3 billion in FY17 to \$4.6 billion in FY19, a 5.8 per cent increase over the two years (an average annual growth rate of 2.9 per cent).
- Australia’s space industry revenue as a percentage of Gross Domestic Product (GDP) is small (relative to the OECD average) at approximately 0.25 per cent<sup>6</sup>.

Further, a growing investment pipeline into the Australian civil space sector has been identified, valued at a total of approximately \$2.02 billion. This includes \$774.6 million inbound investment from private industry and international space agencies. In addition, the Square Kilometre Array (SKA) project will attract an estimated \$1.8 billion in foreign income flows into Australia as a result of the SKA Observatory’s first 30 years of operations.

While these results indicate progress to FY19 and a promising pipeline of future investment, the Agency has since been implementing a national plan to achieve the goals as set out in the Strategy under four strategic pillars: International, National, Responsible and Inspire. Since FY19, the Agency has been delivering the following civil space programs to accelerate the growth of Australia’s space sector:

- The \$15 million International Space Investment (ISI) Initiative;
- The \$19.5 million Space Infrastructure Fund (SIF); and
- The \$150 million Moon to Mars (M2M) initiative.

In addition, the Australian Government’s Modern Manufacturing Strategy<sup>7</sup> identifies space as a priority area for action, as part of its commitment to scaling a strong, modern and resilient economy. The impacts of these

<sup>6</sup> AlphaBeta (2020), [The Economic Contribution of Australia’s Space Sector in 2018-19](#) Note, Australian GDP for 2018-19 was \$1.89 trillion and AlphaBeta estimated space sector revenue was \$4.8 billion.

<sup>7</sup> Australian Government (2020), Make it happen: [The Australian Government’s Modern Manufacturing Strategy](#)



and other initiatives will be presented in the next report, anticipated to cover the period FY19 to 2020-21, when the Agency will be entering Phase 3 of the Strategy – *Delivering success (2021-2028)*.

Building on the publication of the *Economic Snapshot* report, and following a thorough investigation into options (informed by lessons learned in developing the Snapshot) for ongoing monitoring of the sector's progress towards the Government's goals, a plan for regular biennial publication of the economic analysis of the Australian space sector has been established. Engagement with stakeholders on the plan will commence in Q3 of 2021.

# International

*Leverage international bilateral and multilateral partnerships that, where consistent with our national interests, open the door for Australian innovators and grow a connected, respected and globally competitive space industry in Australia.*

## International engagement

As outlined in the *Australian Civil Space Strategy 2019-2028*, one of the Agency's key responsibilities is to transform and grow a globally respected Australian space industry through strong national and international engagement. The Agency continues to actively engage internationally, establishing and maintaining genuine relationships to open doors for Australia.

### United States

Australia's most significant space engagement with the United States during 2020-21, was the signing of the Artemis Accords in October 2020. During the virtual International Astronautical Congress (IAC), Australia became one of eight founding signatories to the Artemis Accords, which seeks to establish a common set of principles, guidelines, and best practices to govern the civil exploration and use of outer space. The other founding signatories to the Artemis Accords are: Canada, Italy, Japan, Luxembourg, United Arab Emirates (UAE), United Kingdom (UK) and the United States (US).

The Accords aim to increase the safety of operations, reduce uncertainty, and promote the sustainable and beneficial use of space. They include principles on transparency, interoperability, preserving outer space heritage, space resources, de-confliction of space activities and orbital debris. The Artemis Accords are consistent with Australia's international obligations. As Australia undertakes activities under the Artemis Accords, the Agency will be guided by its values. These include being a responsible global citizen, ensuring national safety and security, and meeting our international obligations.

On 14 July 2020, the Agency signed an agreement with NASA to take part in its Global Learning and Observations to Benefit the Environment (GLOBE) program. The GLOBE program aims to support student achievements in science and maths through real-time data collection, learning about the Earth and solving environmental problems.

The US Secretary of State and Secretary of Defence hosted the Minister for Foreign Affairs and Minister for Defence in Washington on 28 July 2020 for the 30th Australia-United States Ministerial Consultations (AUSMIN 2020). These consultations provide a significant opportunity to discuss perspectives and approaches on global and regional political issues, and to deepen bilateral foreign security and defence cooperation. Within this forum, civilian space collaboration was positively referenced.

On 25 September 2020, the Agency along with Austrade, CSIRO and DFAT partners, co-hosted the virtual G'day USA Australia Industry Space Xchange. There were over 600 RSVPs to the event, including a mix of Australian and US businesses, academics and primes. Head of Agency Dr Megan Clark joined Dr Larry Marshall, Chief Executive of CSIRO and Lt General Larry James, Deputy Director of NASA's Jet Propulsion Laboratory, to help promote discussion and interest in the Australian space ecosystem. Advisory Board

member and former astronaut Pam Melroy moderated the event with assistance from the Australian Consulate in Los Angeles.

In June 2020, the Agency was granted permission to negotiate a Space Framework Agreement with the United States. A Space Framework Agreement is a whole of government treaty-level agreement providing a framework for collaboration on the implementation of space projects and activities spanning multiple departments including the Australian Space Agency, CSIRO, Geoscience Australia, the Bureau of Meteorology and others. Despite various delays (including a change of Administration in the US), the Agency continued to work closely with the US Department of State, NASA and the US Embassy in Canberra to expedite negotiations under the new Administration. The Space Framework Agreement will establish guidelines for government-to-government interactions regarding a range of civil space matters.

The Agency was also granted a mandate to negotiate a Technology Safeguards Agreement (TSA) by the Foreign Minister on 22 June 2021. The negotiation team, led by the Agency and including DFAT, Defence and DISER, is working towards an agreement that benefits both countries. A TSA would allow for the launch and recovery of US technology from Australian soil under strict protocols. A successful treaty negotiation would see Australia join the UK, NZ, India and others which have similar agreements with the United States.

## Europe

### European Commission

The Agency and the European Commission (EC) continued preparations and engagement for an inaugural Australia-EC Space Dialogue, to be held virtually in late 2021. The Dialogue will focus on areas for future cooperation, including space weather and space traffic management, the Galileo navigation system, quantum communications, and spectrum management. The Agency is leading a cross-government coalition including GA, CSIRO, BoM, ACMA and DFAT.

### European Space Agency

In November 2019, the European Space Agency (ESA) received funding for the expansion of its New Norcia space tracking facility in WA, for which CSIRO provides operations and maintenance support. Construction of a new 35-metre deep space antenna was formally announced on 29 April 2021 during a virtual bilateral meeting held between the European Space Agency and the Australian Space Agency. This meeting served to introduce the new Heads of both the Agency, Enrico Palermo, and ESA, Josef Aschbacher. Construction is due to be completed in 2024, with the antenna entering operation in the second half of that year. The New Norcia site will also host a calibration antenna for the BIOMASS mission, due for launch in late 2022.

## United Kingdom

On 23 February 2021, the UK-Australia Space Bridge Framework Arrangement was signed on behalf of Austrade and the Australian Space Agency by the Minister for Industry, Science and Technology, Karen Andrews, at a virtual signing ceremony. Minister Andrews was joined via video by her UK counterpart Amanda Solloway MP, British Parliamentary Under-Secretary of State for Science, Research and Innovation, signing on behalf of the UK Space Agency (UKSA) and the UK Department for International Trade (UK DIT). The Space Bridge will bring benefits to our space industries, facilitating new trade and investment opportunities and the exchange of knowledge and ideas.

Following the signing, the Space Bridge agencies hosted a series of workshop with industry to explain the Space Bridge. The Agency, Austrade, UKSA and UK DIT, with the support from the States and Territories, conducted Space Bridge State & Territory webinars which commenced on 19 May and will complete in July. Also in parallel, the agencies ran a series of webinars commencing on 15 June, showcasing the space sectors of the UK Devolved Nations and English regions. Both sets of webinars were intended to provide an overview

of Australian and UK jurisdictional space sector strategies, support mechanisms, areas of capability and comparative strengths.

Working groups have been established under each of the pillars identified in the Space Bridge to strengthen specific collaboration between the UK and Australian space sectors. These pillars are: Government-to-government; Trade regulation; Business growth; Research and academic.

Under the UK-Australia Space Bridge a number of support initiatives were announced, including SmartSat CRC PhD scholarships supporting UK applicants. Austrade and the Australian Space Agency worked with the UK Science Innovation Network (UKSIN) to negotiate a funding partnership under the UK-Australia Space Bridge between the UKSIN, SmartSat CRC and the UK Space Applications Catapult to develop a grant supporting bilateral space projects. To be launched in July 2021, the grant calls for projects that align to the mutual benefit of the UK and Australia and create collaboration through the Space Bridge across four priority areas:

- Earth Observation and Climate Resilience;
- Agriculture and Land Management from Space;
- Enabling Connectivity and Innovative Space Communications; and
- Quantum Technologies for Space.

In May 2021, LatConnect 60 and Surrey Satellite Technology Ltd (SSTL) announced the first partnership under the UK-Australia Space Bridge. Under the arrangement LatConnect will make available high resolution optical data from the SSTL S1-4 Earth observation satellite.



*Figure 5 – Virtual signing of the UK Space Bridge Framework Agreement 23 February 2021*

## Italy

Across 2020-21, the Agency continued its ongoing regular meetings with the Agenzia Spaziale Italiana (ASI) to scope a joint payload activity on board the International Space Station.

In August 2020, the Agency undertook formal consultations with Australian industry to assess local industry capability to undertake technical solutions for the payload activity. This consultation resulted in 83 responses.

## Japan

On 7 July 2020, the Agency and the Japan Aerospace Exploration Agency (JAXA) signed a Memorandum of Cooperation (MOC) on *Space Cooperation for Peaceful Purposes*, which allows for expanded cooperation between the two space agencies. This MOC was acknowledged by the Australian and Japanese Prime Ministers during their virtual leaders meeting on 9 July 2020, recognising an important milestone in Australia and Japan's space cooperation.

On 14 July 2020, JAXA and the Agency announced 6 December 2020 as the target re-entry date for Hayabusa2's asteroid sample return capsule, subject to approval under the Space Activities Act (1998). In August 2020 the Japan Aerospace Exploration Agency (JAXA) was granted an Authorisation of Return of Overseas Launched Space Object for Hayabusa2. The Agency coordinated with JAXA on the Hayabusa2 re-entry and the regulatory aspects of the mission. Regulatory approval required the Agency to coordinate with the Departments of Defence, Home Affairs, Agriculture, Water and the Environment, and the South Australian Government, to advise JAXA on Australian entry requirements under pandemic restrictions, and the import and export of the asteroid sample and the equipment necessary for the recovery. Further information can be found in the case study below.

The Agency is the Australian representative for the Asian Beneficial Collaboration through "Kibo" Utilisation (Kibo-ABC) – an initiative used for research on space medicine, biology, Earth observations, biotechnology and communications in Japan's Kibo ISS module. Through Kibo-ABC, the Agency is supporting many of JAXA's international education programs to run simultaneously in Australia, including the Kibo Robot Programming Challenge (Kibo-RPC), and Seeds in Space (Asian Herbs in Space). The Agency is working with a local organisation, the One Giant Leap Australia Foundation, to undertake these programs in Australia.

As part of the Seeds in Space program, golden wattle seeds from the Australian Tree Seed Centre at CSIRO were sent to the International Space Station (ISS) in December 2020, for the "What'll Happen to the Wattle?" program. The seeds will return to Earth in July 2021 and be distributed to 300 national locations for planting.

On 8 October 2020, the Australian finalist team 'GalenVEX' from Wangaratta (VIC) competed in the international Kibo-RPC finals. The team placed third in the on-orbit challenge, where their code was executed live in the International Space Station by the 'Astrobee' robot. The preliminary round for the 2021 Kibo-RPC Challenge commenced in June 2021, with 17 teams from Government, Catholic and Independent schools in NSW, Victoria, and South Australia participating.



## Case study: Hayabusa2 Sample Return



*Figure 6 – (top) Recovery of the Hayabusa 2 sample return capsule after landing in the Woomera Prohibited Area and (below) NASA’s SCIFLI team and Australian Space Agency staff at Adelaide Airport*

On 6 December 2020, the Japan Aerospace Exploration Agency (JAXA) successfully recovered the Hayabusa2 return capsule, containing samples from asteroid Ryugu, in the Woomera Prohibited Area. This operation required coordination across a number of government departments and agencies.

An Authorisation of Return of Overseas Launched Space Object was granted to JAXA by the Minister for Industry, Science and Technology in August 2020 for the return of the Hayabusa 2 sample capsule. The Agency worked closely with JAXA, NASA, the Department of Defence and the South Australian Government to ensure the mission was conducted under strict pandemic restrictions.

Thirty NASA staff were required to enter the country to support the mission, including the airborne observation crew from NASA’s Scientifically Calibrated In-Flight Imagery (SCIFLI) team. They performed airborne observations of the re-entry and recovery, using two NASA aircraft that were based in Adelaide. The Agency supported the activities of the NASA personnel from their base in Adelaide.

Five Agency team members, including then-Head Dr Megan Clark AC, travelled to Woomera to support the re-entry and recovery, while the Agency’s Regulations team, in Canberra, performed checks and coordinated approvals on the re-entry. The ABF provided guidance and facilitation for the recovery mission, assisting JAXA, NASA and the Agency on customs formalities for the capsule and supporting technical equipment, clearance of JAXA and NASA staff and onsite support to clear the outbound charter flight from Woomera returning the asteroid samples to Japan.

After a journey of over 5 billion kilometres, Hayabusa2 returned to Earth and its sample capsule was successfully recovered on 6 December. The capsule was returned to Japan and opened in JAXA’s specialised facilities where it confirmed that samples from the asteroid Ryugu had been collected and preserved.

Based on the significance and the success of the mission, NASA collectively nominated the Agency, JAXA and NASA for a NASA Group Achievement Award. The Agency’s Hayabusa2 project coordinator, Caitlin Caruana, received JAXA’s Institute of Space and Astronautical Science Award for 2020 for her contribution to the recovery project.

## India

India is continuing preparations for its Gaganyaan mission which would make it the fourth country to launch humans into space. This ambitious project, led by the Indian Space Research Organisation (ISRO), takes its name from the Sanskrit for “Sky Craft”. The Agency is continuing to lead cross-Commonwealth coordination on ISRO’s request to place temporary ground station tracking facilities in the Cocos (Keeling) Islands to support the Gaganyaan missions.

In October 2020, the Agency participated in the India International Space Conference and Expo. The Deputy Head featured in the opening session alongside the Chair of the ISRO and senior representatives from CNES, the Czech Republic and the Indian Government.

On 17 February 2021, the 2012 *Memorandum of Understanding with India Concerning Cooperation in Civil Space Science, Technology and Education* was updated. The amendment builds on the Comprehensive



Strategic Partnership between Australia and India announced by Prime Minister Scott Morrison and Prime Minister Narendra Modi in 2020 and will further unlock space collaboration between the two countries.

## Canada

On 8 April 2021, the Agency held a virtual bilateral meeting with the Canadian Space Agency (CSA). The discussions covered introductions for Enrico Palermo and Lisa Campbell, President of the Canadian Space Agency, and potential bilateral activity over the coming year.

## New Zealand

The New Zealand Space Agency has engaged in the Technical Advisory Groups established to support the development of the Agency's Technology Roadmaps.

## France

The Agency, working with CSIRO, has organised a personnel visit from the French national space agency, Centre National d'Études Spatiales (CNES), to support the Agency in developing technology roadmaps for Australia's National Civil Space Priority areas. Originally scheduled for early 2021, COVID-19 travel restrictions have delayed commencement of this visit until late 2021.

## South Korea

The Agency, with Austrade and the Australia-Korea Foundation, conducted an industry-focussed Australia-Korea Space Forum in June 2021. This was a successful event with follow up anticipated.

On 12 June 2021 Prime Minister Morrison and President Moon met bilaterally on the margins of the G7 Summit in Cornwall, UK, where they agreed to closer collaboration across a range of sectors including the digital economy, defence and infrastructure. This may open further opportunities for collaboration between the space sectors of the two nations.

## Bilateral Meetings

The Agency held virtual bilateral meetings with the DLR, ESA, UKSA, NZSA, ASI, UAESA, CSA and JAXA between 26 June and 7 July 2020. The meetings provided an opportunity for the Agency to update its international counterparts on the work the Agency has progressed in the last year and to explore future collaborative activities.

## Other International Engagement

In partnership with CSIRO, the Agency represents Australia on the International Space Exploration Coordination Group (ISECG) and International Mars Exploration Working Group (IMEWG), an international forum established with the goal to foster international co-operation in relation to the exploration of Mars. The IMEWG aims to foster, facilitate, and help co-ordinate international Mars exploration activities such as to be complementary with existing mechanisms used at national, bilateral and multilateral levels by existing international organisations. The Bureau of Meteorology is an observer to the IMEWG.

## SCC members

A summary of SCC member contributions is outlined below.

*Table 2 – SCC international engagement activities*

Organisation	Summary of activity
Australian Antarctic Division	<p>The Australian Antarctic Division (AAD) has an ongoing collaboration with the NASA Office of the Chief Health and Medical Officer, using Antarctica as a space analogue environment. It also has a collaboration with the Translational Research Institute for Space Health, a US-based consortium seeking to solve the challenges of human deep space exploration.</p> <p>AAD is a member of the Scientific Committee on Antarctic Research (SCAR) and the Council of Managers of National Antarctic Programs (COMNAP) Joint Expert Group on Human Biology and Medicine (JEGHBM), an Antarctic medical coordinating group with representation from space agencies.</p> <p>Through its international involvements, the AAD highlights the Australian Antarctic Program as a space analogue for research and operational matters.</p>
Australian Communications and Media Authority	<p>The ACMA engages internationally on the coordination, development and implementation of measures to enhance spectrum usage for satellite communications and space research services. Australia is a member of the International Telecommunications Union (ITU) and the Asia-Pacific Telecommunity (APT). The ACMA is participating in international study groups and working parties in preparation for the World Radiocommunication Conference 2023.</p>
Austrade	<p><u>Australia-UK Space Bridge</u>: Austrade is a key partner for the Australia-UK Space Bridge. It is directly responsible for the Trade, Investment and Business pillar and also plays a support role to the Research &amp; Education, Regulations and Government pillars.</p> <p>Between May 12 and July 14 2021 Austrade and the Australian Space Agency arranged series of digital roadshows showcasing the space capabilities and government support on offer across Australia’s States and Territories to a UK audience. These sessions were recorded and posted on the <u>Austrade</u> website.</p> <p>Austrade and the Australian Space Agency will support an Australian space sector session, held under the banner of the UK-Australia Space Bridge, at the next UK Space conference (end September 2021).</p> <p>Based on Austrade’s successful Fintech Export Academy, Austrade and the Australian Space Agency are planning a UK-Australia Space Export Academy that will deliver a series of workshops for Australian space companies that are seeking to expand internationally.</p> <p><u>Colorado Digital Space Symposium Series</u>: Following the postponement of the 36th Colorado Space Symposium due to COVID-19, Austrade organised a series of 7 virtual events dubbed the Digital Space Symposium. These commenced in April 2020 and concluded in October 2020.</p> <p><u>Australia-Korea Space Forum</u>: 2021 is 60th anniversary of diplomatic relations between Australia and the Republic of Korea. Recognising that space is a strategic priority for both countries, Austrade – supported by the Australian Space Agency – worked with Griffith University, the Korean Embassy in Australia and the Korea Aerospace Research Institute (KARI) to deliver the inaugural ‘Australia-Korea Space Forum’ on 17-18 June 2021. The forum focused on key issues impacting space and highlight ways in which our two countries can work more closely. The Forum was supported by the Australian Space Agency, the Australian Trade and Investment Commission, the Australia Korea Foundation and the Korean Ministry of Science and Technology.</p> <p><u>Canada-NZ-Australia Space Round Table</u>: Austrade and the Agency are working to support a trilateral virtual event between Canada, Australia and New Zealand, in October 2021. The event will be an opportunity to showcase Australian capability across three of Australia’s space priority areas: Earth Observation, Space Situational Awareness and Robotics and Automation. This event will provide business matching opportunities for participating Australian companies and highlight areas of capability and complementarity across all three countries.</p>

Organisation	Summary of activity
	<p><u>Australia's Space Value Proposition</u>: Austrade has led development of a 'Space Value Proposition' for Australia. This work provides key figures and a narrative around Australia's commitment to and comparative advantages in the space sector. It has been designed to support Australian space sector promotion in international markets and in international facing activities in Australia. This work is currently being finalised.</p> <p><u>Investor support</u>: Austrade has provided ongoing support to international space investors that have demonstrated concrete interest in expanding in Australia in areas that support the growth of the space ecosystem.</p>
Bureau of Meteorology	<p><u>Earth observations</u></p> <p>The Bureau of Meteorology is an active member of the World Meteorological Organization (WMO) and a key contributor to the WMO Integrated Global Observing System (WIGOS). It participates in, and leads, a number of expert teams relating to Earth observation and the international exchange of meteorological observations. Through WMO, the Bureau leverages Australia's investment in in-situ observations to obtain global observations and data from a wide range of meteorological satellites.</p> <p>The Bureau has a number of EO-related bilateral agreements with meteorological services and space agencies in Japan, China, Korea, and the US.</p> <p>Under international agreements, the Bureau operates a ground station near Darwin for the COSMIC-2 (Constellation Observing System for Meteorology, Ionosphere, and Climate) program and a Turn Around Ranging Station (TARS) for satellites in China's Fengyun-2 series at Crib Point, Victoria.</p> <p>The Bureau participates in a number of activities aimed at helping other meteorological services improve their access to EOS data. The Bureau currently leads a WMO Region-V (Asia-Pacific) Task Team on Satellite Utilization which aims to improve access to meteorological satellite data and products within the region, and provide guidance on the transition of receiving hardware as new missions are launched. This is supported by the effort and expertise of the Bureau's Satellite Virtual Laboratory Centre of Excellence, which conducts monthly online Regional Focus Group meetings, attended by participants from across the South Pacific each month.</p> <p>The Bureau also participates in the Direct Broadcast Network for Near Real-Time Relay of Low Earth Orbit Satellite Data (DBNet) for the Asia Pacific. These are operational arrangements for the real-time acquisition of polar-orbiting satellite data and their rapid delivery to the global user community through regional processing centres.</p> <p>The Bureau is an Associate Member of Committee on Earth Observation Satellites (CEOS), and member of the CEOS Sea Surface Temperature Virtual Constellation (SST-VC). It is also:</p> <ul style="list-style-type: none"> <li>• Member of the Sentinel-3 Validation Team for Temperature (S3VT-T)</li> <li>• Member of the Group for High Resolution Sea Surface Temperature (GHR SST) Science Team and GHR SST Advisory Board</li> <li>• Member (and current Chair) of the WMO DBNet Coordination group</li> <li>• Member of the WMO Expert Team on Space Systems and Utilization (ET-SSU)</li> <li>• Co-chair of the International TIROS Operational Vertical Sounder (TOVS) Working Group on Numerical Weather Prediction</li> <li>• Member of the NASA CloudSat science team</li> <li>• Member of the NASA Global Precipitation Measurement Mission (GPM) Ground Validation team.</li> </ul> <p><u>Space Weather</u></p> <p>The Bureau's Space Weather Services (SWS) is a member of the International Space Environment Service (ISES) and operates the ISES Regional Warning Centre (RWC) for the</p>

Organisation	Summary of activity
	<p>Australasian region. SWS currently has two representatives on the ISES Directing Board: the Secretary for Space Weather and the RWC Australia delegate</p> <p>SWS is a member of the International Space Weather Initiative (ISWI). ISWI is a program of international cooperation and capacity building sponsored by UNCOPUOS, to develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather.</p> <p>SWS represents Australia on the WMO Inter-Program Team on Space Weather Information, Systems and Services (IPT-SWEISS) coordinating the international availability and access to space weather data.</p> <p><u>International Radiocommunications</u></p> <p>The Bureau regularly participates in World Radio Communication Conferences and the APT Conference Preparatory Group meetings. The Bureau is also a member of the World Meteorological Organisation Steering Group on Radio Frequency Coordination (SG-RFC).</p> <p>The Bureau is an observer to the IMEWG, an international forum established with the goal to foster international co-operation in relation to the exploration of Mars.</p>
CSIRO	<p>CSIRO's key operational agreements are:</p> <ul style="list-style-type: none"> <li>• Agreement between the Government of Australia and the Government of the United States of America concerning Space Vehicle Tracking and Communication Facilities</li> <li>• Agreement between the Government of Australia and the Government of the United States of America concerning the Conduct of Scientific Balloon Flights for Civil Research Purposes.</li> <li>• CSIRO-JAXA Collaborative Agreement for the Conduct of Scientific Balloon Flights for Civilian Research Purposes.</li> </ul> <p>As part of the Deep Space Network, the Canberra Deep Space Communications Complex (CDSCC) will support the Artemis lunar mission planned for 2024. CSIRO also provides operations support for the ESA deep space tracking station at New Norcia, WA.</p> <p>In 2020-21 CSIRO continued to build on its partnership with UK-based Surrey Satellite Technology Ltd for a 10% share of the tasking and data acquisition capabilities of the NovaSAR-1 S-band Synthetic Aperture Radar (SAR) satellite.</p> <p>Additional international agreements and partnerships:</p> <ul style="list-style-type: none"> <li>• CSIRO–ESA Memorandum of Intent on Earth observation, with a focus on science and technology cooperation</li> <li>• CSIRO–DLR Letter of Intent to grow collaboration around space, aeronautics and energy research</li> <li>• CSIRO–Vietnam National Space Centre Memorandum of Understanding (MOU), with focus including Earth Observation using synthetic aperture radar (SAR) satellites</li> <li>• CSIRO–CSA Letter of Intent for Furthering Scientific Cooperation, focusing on activities in Earth observation</li> </ul> <p>CSIRO and GA represent Australia and the Australian Space Agency on key programmatic aspects of international coordination on Earth observations from space.</p> <p>CSIRO is a member of the Committee on Earth Observation Satellites (CEOS) and the Group on Earth Observation (GEO). CSIRO serves in leadership positions within the international CEOS and inter-governmental GEO community.</p> <p><u>CEOS</u>: Two-year Co-Chair (2019-2021), with GA, of the Strategic Implementation Team (SIT), to lead space data providers and ensure CEOS delivers its Work Plan.</p>

Organisation	Summary of activity
	<ul style="list-style-type: none"> <li>• Chair (2018-2020) of the Working Group on Calibration &amp; Validation (WGCV)</li> <li>• Chair (2019-2020), Working Group on Information Systems and Services (WGISS)</li> <li>• Co-Lead of the Ad Hoc Team on Sustainable Development Goals (AHT-SDG)</li> <li>• Contributor to the Working Group on Disasters, recently stimulating the creation of a wildfires sub-team.</li> </ul> <p><u>GEO:</u></p> <p>CSIRO is a member of the Australian Government delegation together with GA and the Bureau.</p> <p>CSIRO represents CEOS on the GEO Executive Committee and (as first alternate) on the GEO Programme Board.</p> <p>CSIRO is a member of the Group on Earth Observations Global Agricultural Monitoring (GEOGLAM) Advisory Committee.</p> <p>CSIRO and Geoscience Australia co-lead the GEO Pacific Island Advisory Group (PIAG).</p> <p>CSIRO promotes Australian space expertise internationally at all strategic and annual GEO and CEOS events (Symposia, Fora and Plenaries).</p> <p>CSIRO was appointed by the UN Convention to Combat Desertification to revise and update the Good Practice Guidance document to include new tools and datasets, and define methods to link assessments of land degradation at global to local levels.</p> <p>CSIRO is deploying the Earth Analytics Science and Innovation (EASI) DataCube technology in Singapore and partnering with Geoscience Australia to launch the platform as a basis for collaboration with ASEAN organisations on climate smart applications.</p> <p>CSIRO is a member of the Asia Pacific Regional Space Agency Forum (APRSAF).</p> <p>CSIRO is a member of the ISECG and IMEWG, contributing to concepts and technical input for the exploration of space in partnership with the Australian Space Agency.</p> <p>In 2020 CSIRO provided expertise to the ISECG Technical Working Group on space communications and in situ resource utilisation, resulting in two reports on technology gaps for lunar support.</p> <p>CSIRO is a member of the International Astronautical Federation and supported Australian Government participation in the 2020 International Astronautical Congress.</p> <p>CSIRO was a major sponsor of the Committee on Space Research (COSPAR) 2021 conference and contributed scientific papers.</p>
<p>Department of Industry, Innovation, Science, Energy and Resources</p>	<p><u>Square Kilometre Array project</u> (a significant scientist project)</p> <p>The Commonwealth of Australia ratified the Square Kilometre Array Observatory (SKAO) Convention in September 2020, and the Convention came into force in January 2021. The Convention establishes the SKAO as the inter-governmental organisation responsible for building and operating the SKA telescopes. As a member country of the SKAO, the Commonwealth of Australia is represented by DISER officials at its governance committees and subcommittees: the Council, the Committee of Council, and the Finance Committee and its three subcommittees.</p> <p>The Department has national committees to engage with Australian stakeholders and inform Australia’s position at SKAO governance meetings: the Australian SKA Coordination Committee and the Australian Science Advisory Committee. Additionally, the department established the Regional Stakeholder Group and the Australasian SKA Industry Cluster to keep industry and local stakeholders updated on project developments and provide them with a voice in the project.</p> <p>The SKA project will attract an estimated \$1.8 billion in foreign income flows into Australia as a result of the SKAO’s first 30 years of operations.</p>

Organisation	Summary of activity
	<p><u>Optical astronomy – European Southern Observatory (ESO)</u></p> <p>The government remains committed to the 10-year Australia-ESO Strategic Partnership Arrangement. This is a sub-treaty MOU between the Australian Government and the ESO that commenced on 11 July 2017. Under the terms of the Australia-ESO Strategic Partnership, Australia appoints Observers to the ESO Council and Finance Committee. ESO appoints Australian representatives to the ESO Scientific Technical Committee and ESO Users Committee.</p> <p>DISER appoints and convenes quarterly meetings of the Australia-ESO Coordinating Group, comprising the ESO governing body representatives and leaders of key Australian astronomy organisations. This is to inform Australia’s position in ESO governing body meetings, liaise with the Australian astronomy community, and provide expert advice on strategic matters relating to both the ESO partnership and Australia’s domestic optical astronomy capacity.</p>
<p>Department of Infrastructure, Transport, Regional Development and Communications</p>	<p>Australia is a party to the Constitution and Convention of the International Telecommunications Union (ITU). Australia is also involved in agreeing and ratifying the changes made to the Radio Regulations. These treaties govern the global use of radio frequency spectrum and satellite orbits. DITRDC leads Australia’s engagement in international radiocommunications fora that develop revisions to the ITU Radio Regulations.</p> <p>Australia is also a party to the Constitution of the Asia Pacific Telecommunity, which established the APT, the regional focal point for ITU related discussions in the Indo-Pacific region.</p> <p>Throughout the multi-year World Radiocommunication Conference (WRC) cycle, DITRDC leads Australia’s multi-stakeholder delegations to meetings of the ITU-R and APT, which include discussions of satellite and space radiocommunication issues, and eventually the World Radiocommunication Conference itself.</p> <p>DITRDC is currently involved in the study cycle for the next WRC, scheduled to take place in late 2023 (WRC 23). The WRC 23 agenda includes over 30 items, several of which cover space-related issues.</p> <p>In 2020-21, DITRDC led Australian delegations consisting of government and industry representatives to the first two meetings of the Asia-Pacific Telecommunity Preparatory Group for WRC-23 (APG23). This forum develops harmonised regional views on WRC-23 agenda items. In 2021-22, DITRDC continues to engage with the WRC 23 study cycle, including further meetings of the APG.</p> <p>DITRDC also hosted multiple meetings of the Australian Preparatory Group for WRC-23 (PG WRC-23), consisting of government and industry stakeholders, including satellite operators, in the lead-up to each major regional or international meeting.</p> <p>AMSA is an active participant in international bodies, such as the International Maritime Organization (IMO), International Telecommunications Union (ITU), International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), International Civil Aviation Organisation (ICAO) and COSPAS-SARSAT, which deal (in part) with radio-navigation and satellite-based systems, procedures, policies and radiocommunication.</p> <p>AMSA is coordinator of an International Maritime Organization (IMO) correspondence group to consider options to address cost implications for maritime safety information (MSI) and search and rescue (SAR) information providers concerning the dissemination of information over multiple Global Maritime Distress and Safety System (GMDSS) recognized mobile satellite services.</p> <p>AMSA is a member of the COSPAS-SARSAT Council, participating in the Joint Working Group, and the South West Pacific Data Distribution Region Working Group.</p>



Organisation	Summary of activity
	<p>AMSA is also contributing to an informal working group on the revision of a general performance standard for shipborne satellite navigation system receivers for the provision of position, navigation, timing (PNT) and associated information.</p> <p>Australia is also a party to the Convention on International Civil Aviation (Chicago Convention) and a member of ICAO, the United Nations agency responsible for developing standards and policies for global civil aviation. ICAO works closely with the United Nations Office for Outer Space Affairs (UNOOSA) to cooperate and coordinate on the development of aviation and aerospace activities.</p> <p>DITRDC participated in ICAO's 40th Assembly in September 2019, at which a Resolution concerning commercial space transport (Resolution A40-26) was adopted. Amongst other things, the Resolution recognises the need for ICAO to work with other UN entities, in particular UNOOSA and UNCOPUOS, and reaffirms the role of ICAO in developing policy guidance in the areas where international commercial space transport operations intersect with international civil aviation, in coordination with the UNOOSA. A key focus of discussions at the Assembly was the need for the growing civil space sector to be safely interoperable with the existing global air traffic management system and supporting infrastructure.</p> <p>ICAO is consulting with member States on a number of proposals for amending global aviation safety standards. Changes are proposed to Annex 10 to support the introduction of dual-frequency, multi-constellation (DFMC) global navigation satellite systems (GNSS) by adding provisions for additional frequencies of operation for the Global Positioning System (GPS), the Global Navigation Satellite System (GLONASS) and the satellite-based augmentation system (SBAS), and by introducing provisions for the new BeiDou Navigation Satellite System (BDS) and Galileo system.</p> <p>An amendment to support ionospheric gradient mitigation for the ground-based augmentation system (GBAS) is also being proposed. DFMC GNSS offers an opportunity to further enhance GNSS robustness, navigation performance and operational benefits. Technical improvements will enable, amongst other things, operational benefits in terms of safety and efficiency, such as improved operational reliability for Communication and Navigation System (CNS) applications.</p> <p>CASA communicates with international civil aviation authority counterparts on space-related issues on best practice and whole of-government cooperation. CASA engages, as required, with international space agencies, particularly where launch and return activities are undertaken in Australian airspace. Most recently, this included working with the United States (NASA) and Japan (JAXA) on successful Hayabusa 2 operations in Australian airspace in the second half of 2020.</p> <p>Airservices is in discussions with the Civil Aviation Authority in Singapore and will be looking to continue to work with industry to explore potential collaboration opportunities on technical studies in relation to the viability of space based technologies. Airservices will also approach the Department of Transport in Canada to discuss progress in the viability of aeronautical communications via space.</p>
<p><b>Department of Defence</b></p>	<p>Defence engages with international partners on the military use of space through Combined Space Operations (CSpO) and bilateral partnerships and talks.</p> <p>The Combined Space Operations Initiative is a military space partnership with Canada, France, Germany, New Zealand, the United Kingdom and United States. The Initiative actively works together to improve defence space coordination, enhance individual and collective space capabilities, and strengthen norms and standards of behaviour in space.</p> <p>Defence is a founding member of the CSpO Initiative and participates in a number of working groups within the initiative covering operations, policy and capabilities.</p> <p>Bilateral partnerships with likeminded nations and allies enable the sharing of space related information and resources to synchronise space operations, and reinforces the</p>

Organisation	Summary of activity
	<p>importance of the responsible use of space between defence departments. The Defence Science and Technology Group (DSTG) has strong bilateral space science and technology relationships with Australia's traditional partners, including the UK and US, and is working to expand space-related relationships with other countries including regional partners.</p> <p>DSTG's international engagement is critical for conducting world class space research, and includes strong multilateral space relationships with Canada, Germany, Italy, the Netherlands, New Zealand, Norway, Spain Sweden, the UK and the United States.</p> <p>Defence also maintains a number of bilateral MOUs with the United States and maintains partnerships with other international partners with respect to satellite communications.</p> <p>DSTG undertook a collaboration with JAXA, as part of its Hayabusa 2 mission. The re-entry of Hayabusa2 at the Woomera Prohibited Area was observed with multiple research and development sensors operated by DSTG and its partners.</p> <p>The annual Satellite Communications Working Group hosted by the United States provides opportunity for the United States and its international partners to share information on current and future programs and discuss issues for resolution.</p>
<p>Department of Foreign Affairs and Trade</p>	<p>DFAT supported Australia's negotiations on, and eventual signature to, the Artemis Accords with the United States.</p> <p>DFAT has engaged with a range of bilateral partners on space security and disarmament issues.</p> <p>DFAT will also support Australian negotiations with the United States to develop a bilateral TSA to facilitate US involvement in space launch activities from Australia.</p>
<p>Department of Home Affairs</p>	<p>The Cyber and Infrastructure Security Centre, representing Australia, is currently the secretariat for the Critical Five (C5) and the C5 GNSS subgroup. The C5, comprising Australia, Canada, New Zealand, the UK and US, is the forum for the five country collaborative partners' approach to critical infrastructure resilience. Participation in C5 and the GNSS subgroup is a valuable opportunity to share information on threats to critical infrastructure, mitigation approaches and policy.</p> <p>In December 2020, the ABF provided import and export policy support for the return to Earth of the Japanese Hayabusa2 spacecraft capsule, which landed in the Woomera Prohibited Area in South Australia.</p> <p>Customs and Trade Policy Branch and Australian Border Force (ABF) operational teams worked closely with the Australian Space Agency and JAXA to satisfy Australia's customs formalities for the capsule. This support extended to arrangements for the capsule's supporting technical equipment, clearance of JAXA staff, and onsite assistance to clear the outbound charter flight.</p> <p>Also in December 2020, the ABF provided support in the planning phase of the Indian Government's Gaganyaan space mission and provision of advice and requirements to enable a successful project. Future collaboration on the project will include the temporary installation of a tracking facility on the Cocos (Keeling) Islands.</p>
<p>Geoscience Australia</p>	<p>GA is Australia's principal representative to the intergovernmental Group on Earth Observation (GEO). GEO facilitates cooperation between governments, industry and Non-Governmental Organisation (NGOs) to exploit earth observation for societal benefit. GA coordinates Australia's GEO representation which includes participation from CSIRO, the Agency, the Bureau of Meteorology, the Australian Bureau of Statistics and other agencies. Current priorities for Australia's involvement in GEO include supporting the Pacific Island Countries and Territories engagement with GEO, increasing private sector engagement in GEO the promotion of free and open access data and tools, and analysis ready data systems.</p> <p>GA is an associate member of CEOS. Throughout 2020-21, GA has worked with CSIRO to deliver Australian chairmanship of CEOS's Strategic Implementation Team.</p>

Organisation	Summary of activity
	<p>GA continues to explore opportunities for Australian experts to participate in US and European Commission activities for future operational land imaging missions. Engagement in these processes is critical in opening opportunities for future Australian participation or co-investment in the operational missions on which we depend. It has, however, been made more challenging through travel restrictions as a result of the ongoing COVID-19 pandemic.</p> <p>GA cooperates with NASA on the operation of the Yarragadee geodetic observatory in WA. NASA provides the satellite laser ranging (SLR) instrument, and GA provides operational support and facility management.</p> <p>At Yarragadee and Mt Stromlo (ACT) GA, in partnership with CNES, operates two Doppler Orbitography and Radio-positioning Integrated by Satellite (DORIS) beacons. The DORIS beacons support the precise determination of the orbit of low altitude satellites.</p> <p>GA has international agreements in relation to GNSS data sharing and satellite tracking with Japan, India and China. GA also provides GNSS technical support to the Australian Government's Climate and Oceans Support Program in the Pacific (COSPPac).</p> <p>GA continues to collaborate with Land Information New Zealand (LINZ) on the development of a joint SBAS known as the Southern Positioning Augmentation Network (SouthPAN). The name SouthPAN was officially registered through ICAO in late 2020.</p> <p>GA continues to engage with the Government of Japan through the Memorandum of Cooperation with the National Space Policy Secretariat, Cabinet office. This has led to ongoing coordination of the EWS (Emergency Warning Services) and Multi-GNSS Advanced Demonstration Tool for Orbit and Clock Analysis (MADOCA) real time products.</p> <p>GA has formal cooperation arrangements with the US Geological Survey, in relation to the Landsat Earth observation program. As a certified Landsat Ground Network (LGN) contributor, GA operates the Alice Springs Ground Station through which it provides command and control, and data downlink support for Landsat program missions.</p> <p>GA has a formal agreement with the EC around its Copernicus program. Under this agreement GA operates, with CSIRO and state government partners, the Copernicus Australasia Data Hub, providing regional users with access to Sentinel program data.</p> <p>GA is a founding partner of the Open Data Cube (ODC) project. The ODC is open-source software that seeks to increase the value and impact of global Earth observation satellite data by providing an open and freely accessible exploitation architecture. The ODC project seeks to foster a global community to develop, sustain, and grow the technology and the breadth and depth of its applications for societal benefit.</p> <p>Geoscience Australia is in discussion with the South Africa National Space Agency (SANSA) as a key step in transitioning the leadership of Digital Earth Africa (DEAfrica) from Australia into Africa</p> <p>GA is a member of several PNT-related working groups and organisations, including the International GNSS Service (IGS), which is a voluntary federation of over 200 self-funding agencies, universities, and research institutions in more than 100 countries, working together to provide the highest precision GNSS satellite orbits and products.</p>

## International Outreach

### International Astronautical Congress (IAC)

Due to COVID-19 restrictions, the 71st International Astronautical Congress (IAC) was held as a virtual event on 12-14 October 2020. It attracted more than 6,000 attendees from around the world. The Agency, supported by CSIRO, had a virtual presence at the Congress, to engage with online attendees and showcase

Australia's space capabilities and the benefits they can offer the world. The Agency hosted a virtual booth, an important platform to reach global partners during the pandemic. More than 750 people visited the booth during the congress.

The Deputy Head presented a paper on *How new space agencies are supporting human space flight (HSF) – an Australian perspective*. Other Agency staff also presented papers in Congress technical sessions.

## Committee on Space Research (COSPAR) Scientific Assembly

Delayed from August 2020 due to the pandemic, the 43rd COSPAR Scientific Assembly was held in Sydney 28 January – 4 February 2021, with a hybrid in-person/virtual format. The conference was sponsored by DISER, CSIRO, AAD, the Agency, the Bureau of Meteorology, Defence (represented by DSTG) and GA, who were also represented at a Team Australia virtual booth in the congress virtual platform. The Agency was also a sponsor of the planned COSPAR-K public STEM outreach program. However, due to COVID-19 uncertainties, this program was postponed and will be rescheduled.

## Asia Pacific Regional Space Agency Forum (APRSAF)

The APRSAF provides active engagement for the Agency with the regional and emerging space agencies in the Asia Pacific. The planned November 2020 Forum was postponed until November 2021 due to ongoing coronavirus surges and travel restrictions. The Agency also regularly attends meetings of APRSAF's National Space Law Initiative. The purpose of this initiative is to promote information sharing and mutual learning on the practices and examples of national space legislation and/or policies in the Asia-Pacific Region.

## Space Representation at the United Nations

Australia has ratified the five UN treaties that govern space activities. The Agency has responsibility for implementing Australia's obligations under these treaties, including domestic implementation under the Act. The Agency, with support from DFAT, represents Australia at the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and its subcommittees (Legal, and Scientific and Technical).

UNCOPUOS is an important mechanism to support international cooperation, however COVID-19 curtailed its activities in 2020. Decisions and actions by UNCOPUOS and the Legal Subcommittee were instead undertaken by written procedure, which were subsequently agreed by Member States.

The Agency and DFAT attended the UNCOPUOS Scientific and Technical Subcommittee (STSC) meeting in April 2021, and Legal Subcommittee (LSC) in June 2021. Key agenda items included the long-term sustainability of outer space activities, the "Space 2030" Agenda and implementation, and space resource exploration and utilisation. The STSC included the establishment of a Bureau to guide the Working Group on the Long-term Sustainability of Outer Space Activities, while the LSC included the establishment of a Working Group on Space Resources. Mr Andrzej Misztal (Poland) was appointed as Chair of this group, with Professor Steven Freeland (Australia) in the Vice-Chair role.

The Office of the Space Regulator has provided input into: Implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities; supporting the establishment of the Working Group on the Long-term Sustainability of Outer Space Activities under the UNCOPUOS Scientific and Technical Subcommittee, and; Supporting the establishment of the Working Group on Space Resources under the UNCOPUOS Legal Subcommittee.

DFAT leads space security work at the Conference on Disarmament and the United Nations Disarmament Committee, as well as the United Nations First and Fourth Committees. DFAT also participates in the work of UNCOPUOS and its subcommittees.

Australia is working with other countries to reduce space threats through developing and adopting responsible behaviours. Australia seeks to produce a better collective understanding of the current threats to space security and enhance trust and confidence between States to create a more secure space environment. The work should allow all States, regardless of their level of development, to extensively benefit from using space systems even if they do not operate their own.

To advance this agenda, Australia joined with likeminded countries to develop and submit a resolution at the UN First Committee (which deals with disarmament, global challenges and threats to peace) titled *Reducing space threats through norms, rules and principles of responsible behaviours*. The resolution called on Member States to: study existing and potential threats and security risks to space systems, including those arising from actions, activities or systems in outer space or on Earth; characterise actions and activities that could be considered responsible, irresponsible or threatening and their potential impact on international security; and share their ideas on the further development and implementation of norms, rules and principles of responsible behaviours and on the reduction of the risks of misunderstanding and miscalculations with respect to outer space. DFAT coordinated Australia's May 2021 submission on these themes to the [Secretary General](#).

The Bureau of Meteorology is a member of the UNCOPUOS Expert Group on Space Weather. Its Space Weather Services is a member of the International Space Weather Initiative (ISWI). ISWI is a program of international cooperation and capacity building sponsored by UNCOPUOS, to develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather.

DISER's International and Astronomy Branch (IAB) worked with the Australian Space Agency and CSIRO on Australia's statement to the UNCOPUOS Scientific, Technical Sub-Committee, for the 58th session held in April 2021. The IAB input was regarding an International Astronomical Union (IAU) paper 'Dark and Quiet Skies for Science and Society', which analysed impacts of planned large satellite constellations on astronomy.

# National

*From areas of strength and addressing our challenges, transform and grow an Australian space sector that lifts the broader economy and leaps into areas of future competitive advantage.*

The Agency aims to increase national capability through activities primarily aligned with the seven Civil Space Priority Areas, State and Territory engagement, industry partnerships, research and industry-research collaborations and investments through its funding programs, as well as investments by states and territories. This also acknowledges investment by Defence, CSIRO and other agencies across Government, which will further build Australia's national capability. Close coordination with Defence is important as these activities will need to be undertaken consistent with Australia's national and security interests.

Over the 2020-2021 financial year, the Agency provided over \$17 million in grants through its funding programs, an important step in stimulating the space sector and growing our economy. The Agency's major funding programs are: The \$19.5 million Space Infrastructure Fund, designed to fill gaps in critical space infrastructure; \$15 million International Space Investment initiative, developing important international cooperation; and the Australian Government's flagship space program, the \$150 million Moon to Mars initiative. In the May 2021 budget, an additional \$13.3 million was provided to increase the capacity of the Agency to deliver regulatory services and support the growth of the space industry.

Additional funding also became available to the space sector through the Government's Modern Manufacturing Initiative, while on 14 April 2021 the Australian Government announced a major new investment of \$387.2 million in the Square Kilometre Array radio telescope to support it over the next 10 years.

On 25 May 2021 the [Space Industry Skills Gap Analysis](#) report was released by SmartSat CRC. This report is a detailed and in-depth examination and assessment of Australian space-related skills and identifies three hundred and nineteen space-related skills needed to support future needs of the sector. This study was supported by the Australian Space Agency as an initial step to understanding the skills needs of the national space workforce.

In the 2020-2021 financial year, AusIndustry, on behalf of the Australian Space Agency, delivered four programs for a total funding of \$14.7 million in FY 20-21.

- International Space Investment \$4.5 million
- Space Infrastructure Payload \$6.8 million
- Moon to Mars Demonstrator Feasibility \$2.2 million
- Moon to Mars Supply Chain \$1.2 million

## Funding Programs

### Space Infrastructure Fund

In the 2019-20 Budget, the Australian Government allocated \$19.5 million for the Space Infrastructure Fund (SIF) to support Australia's emerging domestic space industry. The SIF was announced on 2 April 2019 and will end on 30 June 2022.



The SIF aims to increase capability and fill space infrastructure gaps to support businesses and researchers to participate in the global space economy. Building a core foundation for space operations and technology will: support the creation of high-tech jobs in Australia; support industry through targeted investments; speed up the delivery of new space-based services; reduce barriers and make space more accessible for start-ups and small-to-medium business and benefit Australians who rely on satellites for daily activities like GPS, communications and farming. The SIF also provides the tools businesses need to access international opportunities – opening doors for Australia internationally.



Figure 7 – Map of the distribution of SIF projects around Australia

The SIF supports seven enabling projects that fill gaps in Australian space infrastructure. *Figure 4* indicates the location and funding allocation for the SIF projects, which are more fully outlined in the [2019-2020 State of Space](#) report.

Six SIF projects were funded in the 2019-2020 financial year, with two facilities officially opened in 2021.

- The Mission Control Centre (MCC), located within the Australian Space Discovery Centre at the Agency Headquarters in Adelaide, officially opened on 31 March 2021, and will be fully operational by June 2022. The MCC is designed to enable SMEs and researchers to control small satellite missions. The Bureau of Meteorology has agreed to provide space weather information to the MCC.
- The Australian Space Data Analysis Facility (ASDAF) provides improved analysis of Earth observation data for SMEs and researchers in fields including agriculture, mining, emergency services and maritime surveillance. It will also provide space situational awareness data for satellite operators. ASDAF officially opened at the Pawsey Supercomputing Research Centre in WA on 25 May 2021 and will be fully operational in 2022.

At 30 June 2021, the remaining four projects showed satisfactory progress towards completion in 2022. Different to the other facility-focussed projects, the Pathway to Launch project was funded to undertake work to address the active interest and growing readiness in industry for launch in Australia, while ensuring safety on Earth and in space. It has supported the operation of the Space (Launches and Returns) Act 2018, including the role of the launch safety officer.

Prior to the award of the seventh SIF grant for National Space Payload Qualification Facilities, the Agency conducted an audit in the second half of 2020 to determine existing capabilities in this area. It found that there were already a range of mandatory testing capabilities available in Australia, such as mechanical

vibration testing for launch and vacuum bake out. The audit also identified gaps or limited availability in testing capabilities that provide greater mission assurance, such as thermal vacuum, altitude control and ionising radiation, and a gap in space radiation testing capability. Access to this capability will enable manufacturers to confidently deploy radiation-resistant systems.

In June 2021, a \$2.5 million Space Payload Qualification Facilities grant was awarded to the Australian National University. The majority of the grant will support the Heavy Ion Accelerator Facility at ANU, which will allow spacecraft components to be tested against extreme radiation.

## Case study: Pawsey Supercomputing Research Centre



Figure 8 – Entry to the Pawsey Supercomputing Research Centre at Technology Park, Kensington WA

CSIRO is the centre agent for the Pawsey Supercomputing Research Centre, a world-class high-performance computing facility accelerating scientific discoveries for Australia's researchers. Based in Perth, the Centre supports two of the SKA precursor projects, the Australian SKA Pathfinder (ASKAP) and the Murchison Widefield Array (MWA), and is also working on projects with ESA. Its new supercomputer, to be operational in 2022, will power future high-impact Australian research projects by delivering 30 times more computing power than predecessor systems

Supported by the Australian Space Agency's Space Infrastructure Fund, the Pawsey Centre has established a new Australian Space Data Analysis Facility to provide improved analysis of Earth observation and space situational awareness data.

CSIRO operates the Australia Telescope National Facility (ATNF), including ASKAP, located at the Murchison Radio-astronomy Observatory (MRO) in WA and the Parkes radio telescope in NSW. CSIRO will also host the international SKA-Low telescope at the MRO.

## International Space Investment Initiative

In the 2018-19 Budget, the Australian Government committed \$15 million over three years from 2019-20 for the International Space Investment initiative (ISI), to build the Australian space industry by enabling and encouraging engagement with international space agencies. The initiative comprises two streams: the open, competitive Expand Capability stream (approx. \$11 million) with the remaining funds to be deployed to an Open Doors stream, which has yet to be announced.

On 17 June 2020, the ten projects selected to receive grants under the ISI - Expand Capability initiative were announced. Details of the selected projects can be found in the [2019-2020 State of Space](#) report.

Project tracking by the Agency's Program Office indicated that, at 30 June 2021, all ISI projects have proceeded satisfactorily across the 2020-21 financial year. There were no significant issues, and project reports were regularly received.

## Moon to Mars Initiative

In 2019, the Australian Space Agency partnered with NASA on its inspiring plan to return to the Moon and travel on to Mars. The \$150 million Moon to Mars (M2M) initiative will support the transformation of industries across the economy, accelerating the growth of the space sector by providing opportunities to enter national and international supply chains, increasing demand for new capabilities, creating inspiration and enabling spin-out technologies for economic growth. The M2M initiative will benefit local businesses and

researchers in the short term by building capability. In the medium to long term, it will also help secure Australia's economic recovery from the COVID-19 pandemic, creating more high-tech jobs and strengthening industry.

The program includes three integrated programs for which funding commenced in the 2020-21 financial year:

- **Supply Chain program:** consisting of both grant and facilitation components, this program targets projects and activities to build capability in Australia's space industry, and support local industry to deliver products and services into national and international space supply chains.
- **Demonstrator program:** supporting demonstrator and pilot projects for Australian industry and researchers to develop and launch products that will create new capability, and enable new business ventures, revenue streams or markets. This program provides a pathway to showcase Australia's strengths to the world.
- **Trailblazer program:** a major Australian 'foundation services' project supporting NASA's Moon to Mars space exploration program. The intention is to demonstrate Australia's unique strengths in robotics and remote operations and inspire the nation.

On 2 July 2020, the Agency released the [Moon to Mars Initiative consultation outcomes report](#), following public consultation events across the country between 14 February 2020 and 2 March 2020. These consultations were attended by more than 550 people with over 70 submissions received. The report highlighted the key challenges facing the space industry and summarises themes from attendees and consultation submissions.

### Supply Chain Program

On 27 August 2020, the Supply Chain Capability grants were opened by the Minister for Industry, Science and Technology. The Agency hosted its first public webinar and held a number of communication and media activities to amplify.

The first intake for the Supply Chain Capability grants closed on 15 October 2020, with two grants announced on 17 March 2021. One of these recipients, Spiral Blue (NSW), was awarded a grant of \$416,250 to develop Space Edge software for use aboard Earth observation satellites to enable data processing on board the satellite. These powerful and compact computer systems can deliver a report or set of analytics straight from space to improve speed and affordability. Spiral Blue successfully launched the first prototype Space Edge Zero (SEZ) computers into orbit on board Virgin Orbit's air-to-space LauncherOne rocket on 30 June 2021.

The second Supply Chain Capability grant intake closed 17 December 2020, with the two successful applicants announced on 11 June 2021. On 4 May 2021 the third intake for the Supply Chain Capability grants closed. Assessment of applications is underway. It is expected that the grants for this intake will be awarded in Q3 2021.

The Supply Chain Facilitation procurement program released its first tender on AusTender on 9 June 2021.

### Demonstrator Program

Demonstrator Feasibility grant guidelines were approved by the Minister in October 2020. The Demonstrator program is designed with two phases, Feasibility Grants and Mission Grants, to maximise the potential investment into the sector while minimising the risk to the overall program. By the end of the program it is expected that numerous Australian companies and research institutions will have products operating in space.

The \$3.7 million Demonstrator Feasibility program offers grants of between \$50,000 and \$200,000 over a two year period. The aim of the grants is to provide opportunities for Australian businesses and researchers to scope out the feasibility of projects that have the potential to operate or support operations in space. This includes activities that could support NASA's Moon to Mars space exploration program.

The Demonstrator Feasibility grants opened in November 2020. Twenty successful grantees were announced on 18 June 2021, sharing a total of \$4 million in funding to conduct feasibility testing and transform concepts into the next generation of space products and services.

Mission Grant guideline development is underway, with the aim to release the guidelines in late 2021 and open the program for applications in 2022.

*Table 3 – Summary of Demonstrator Feasibility Grant Allocations*

Grant Recipients	Project Title	Description	Budget
Curtin University	Binar Prospector – low altitude exploration of the Moon for accessible In-Situ Resource Utilisation (ISRU)	The project lays the foundation for a lunar orbiter mission – Binar Prospector – that targets the resource potential of the Moon. Mission will consist of 2+ 6U cubesats flying at low altitude and using novel COTS payloads to deliver high resolution digital mapping for ISRU exploration of the Moon.	\$200,000
Australian Remote Operations For Space And Earth Ltd	Lunar Construction Rover Feasibility Study	The project will demonstrate the feasibility of an Australian operated Lunar Construction Rover and Stage 1 Mission scope.	\$200,000
University of Adelaide	Remote sensing using optically enabled formation flying of CubeSats	The project will perform a conceptual design of the 2Qb mission that includes the design of the two CubeSats, inter-spacecraft omnidirectional optical communicators (ISOC) and an Optical Ground Station (OGS).	\$199,506
University of Western Australia	Australian optical communications support for NASA Artemis and beyond	The project will establish an Artemis-compatible optical communications channel over a free-space laser link between the Western Australian OGS and an airborne target that mimics the Orion spacecraft.	\$199,634
Australian National University	Laser technology for the next GRACE Mission	The project will develop laser measurement technology for the next generation gravity sensing mission, slated for launch in the mid-2020s.	\$106,591
Thales Australia Limited	Feasibility of Event Based Vision Sensors (EBVS) servicing the Artemis Spacecraft	Thales will partner the International Centre for Neuromorphic Systems at the Western Sydney University to determine the improvement of the EBVS over existing sensors used in European Robotic Orbital Support Services (EROSS) in high contrast visual environments.	\$199,756
Australian National University	Australian Deep Space Optical Communications Ground Station	The project will prototype and test a deep space optical communications ground instrument compatible with NASA's Optical to Orion (O2O) mission: to demonstrate high speed optical communications between Earth and the Orion spacecraft as it orbits the Moon.	\$200,000
University of New South Wales	Feasibility of a reconfigurable intelligent	The project is designed to be a pathfinder to demonstrate intelligent hyperspectral remote sensing capabilities that can be	\$200,000

Grant Recipients	Project Title	Description	Budget
	hyperspectral satellite mission	reconfigured in-orbit to meet the needs of multiple end-users.	
Queensland University of Technology	Remote Operations for Internal Logistics Handling	Project partners will collaborate on a robotic solution to be used with a pressurized module at the Lunar Gateway to handle internal logistics, remotely supervised from Earth while also having local autonomous operations capabilities.	\$199,500
CD3D PTY Limited	Breakthrough subsurface water-ice detection and geological mapping radars	The project will determine the feasibility of a space-hardened, compact, ultrawideband radar that can be used to sound lunar or Martian geology from surface to depth.	\$197,487
Valiant Space Pty Ltd	Fast Acting Space Transportation (FAST) Demonstrator Mission	The project will investigate and de-risk key elements of the proposed Fast Acting Space Transportation (FAST) Demonstrator Mission.	\$200,000
Abyss Solutions Pty Ltd	Spaceborne robotic inspection and intervention	The project will develop the preliminary design and prototype of a robotic sensor and intervention manipulator package that will undertake asset inspection and repairs for spaceborne operations.	\$109,690
Sperospace Pty Ltd	Multifunction Arm Robot for Space feasibility study and demonstration	The project conducts a feasibility study for the Robotics Satellite Demonstration (RSD) Mission including concept development, a system requirements review, and preliminary design reviews for the mission.	\$200,000
University of Adelaide	Novel fluorescence sensing of materials for Moon to Mars ISRU	The project will discover and characterise novel fluorescence (NF) from minerals and compounds significant to space ISRU, to create a roadmap for design and construction of a NF sensor module including a plan to test the NF sensor module in the Space environment.	\$198,404
University of Sydney	Drilling, Inference, and Navigation for Geological Operations (DINGO)	Through this project, the Australian Centre for Field Robotics at the University of Sydney will investigate adaptive sampling approaches for robotic lunar operations.	\$200,000
Phosenergy Limited	Australian Radioisotope Heater Unit for Lunar Night Survival	The project will design a Radioisotope Heater Unit (RHU) to allow a lunar surface payload to survive and operate over multiple lunar nights.	\$90,000
Enable Aerospace Pty Ltd	Australian Universal Payload Solution for International Space Missions	This project will assess the feasibility of a novel and affordable Universal Payload Rack System (UPRS) to enable non-standard payloads to be sent into space.	\$174,179
Raytracer Pty Ltd	Optimising Computing Interfaces for Human to Machine Lunar Operations	The project will conduct further development of spatial computing interfaces, enabling astronauts to control	\$200,000

Grant Recipients	Project Title	Description	Budget
		lunar robots efficiently and effectively from a lunar surface habitat or vehicle.	
University Of Southern Queensland	Early plant stress detection using machine vision for food safety in space	The project will develop launch-ready software, including recommended machine vision sensors for plant monitoring.	\$200,000
University of Adelaide	Next Generation Phased Arrays for Deep Space Network	The project will conduct a Pre-Phase A study to develop phased array antennas to replace the 70-m parabolic dishes within the DSN	\$199,765

## Trailblazer Program

The Trailblazer program will be a major Australian project supporting NASA’s Moon to Mars space exploration program. It intends to demonstrate our unique strengths in robotics and remote operations, and inspire the nation. This program is currently being designed in conjunction with ongoing discussions with NASA. A public consultation was held in April-May 2021 that included a webinar with over 100 attendees. Over 30 submissions were received. This program’s funding is to be released in Q3 2022.

## Modern Manufacturing Initiative

As part of the 2020-2021 Federal Budget, the Government allocated \$1.5 billion for the Modern Manufacturing Strategy (MMS). The MMS was announced on 1 October 2020, with Space identified as one of six National Manufacturing Priorities (NMP).

DISER has been charged with the delivery of the Modern Manufacturing Initiative (MMI) and the Agency has worked closely with the Manufacturing division of the Department to promote awareness of the MMS within the space sector. This included promoting consulting with industry on the Modern Manufacturing Initiative, which achieved good input from space organisations (34 responses; almost 10% of responses) and helped to identify space industry partners for the Taskforce that led development of the Space National Manufacturing Roadmap.

The Space sector was identified as the initial sector to be targeted by two streams of grant funding in conjunction with the release of the [Space National Manufacturing Priority \(NMP\) roadmap](#) in February 2021. The Space NMP roadmap sets out a vision for government and industry to work together to support a globally recognised Australian space sector, and identifies three key growth opportunities. These are:

- manufacturing products that are launched into space;
- manufacturing space components; and
- manufacturing and production of associated products and infrastructure.

From products to be launched into space, like nano and small satellites, through to the production of space components like sensors and communication arrays, the Space NMP roadmap helps to inform investment decisions and future policy directions that will harness the sector’s strategic strengths, provide innovative solutions, and grow a capable and sustainable Australian space manufacturing industry.

The release of the Space NMP roadmap accompanied the opening of two streams of grant funding worth \$140 million (inclusive for the six sectors, of which Space is one) under the Space Modern Manufacturing Initiative:



- **Integration Stream** is designed to help Australian manufacturers to access domestic and global supply chains.
- **Translation Stream** grants help Australian manufacturers translate high quality research and ideas into commercial outcomes. Collaboration Stream supports large-scale manufacturing projects with business-to-business collaboration and business-to-research collaboration, to build economies of scale. Applications closed on 9 September and are under assessment
- **Collaboration Stream** is the largest component of the MMS, and focuses on long-term transformation in the NMP areas, to support job creation and investment in Australian manufacturing. The \$800 million grant fund will provide project funding of between \$20 million and \$200 million for large-scale projects to support business-to-business and business-to-research collaboration across the Government's six National Manufacturing Priority Areas. It will open in August 2021. The Agency has representation on the MMI – Collaboration Stream evaluation panel.

## Technology Roadmaps

The Agency is developing seven technology roadmaps to guide future investments for the National Civil Space Priority Areas defined in the Australian Civil Space Strategy. Priority has been given to Communication Technologies and Services, Earth Observation, and Remote Operations and Automation.

Significant collaboration across Australian government agencies, research and industry sectors took place throughout 2020-21 to inform roadmap development. Technical Advisory Group workshops and industry consultations were conducted to progress the different stages of each roadmap. Peer space agencies, particularly NASA's Moon to Mars working groups, have continued to validate identified opportunities.

The first roadmap, [Communications Technologies and Services 2021-2030](#) was released on 22 December 2020. It provides the strategic direction to capture opportunities to grow the industry. A virtual information session on the release of the Communications Technologies and Services Roadmap attracted almost 200 attendees and over 500 downloads of the roadmap had occurred by February 2021. Several international agencies have engaged with the Australian Space Agency to gain more insight on some focus segments highlighted in the roadmap and explore potential collaborations. Potential collaborations for implementation of the Communications Technologies and Services Roadmap have been identified with the Defence Industry Hub (DIH) and options for a Communications Technology working group to explore opportunities are being developed and considered.

The Agency supported several Space Mission Development Studies with GA, BoM and CSIRO to inform the Earth Observation Roadmap on potential partnership with international organisations. In March 2021, The GA-led "Technical Feasibility Study into Australian Development of a Satellite Cross-Calibration Radiometer (SCR)" was released, with the BoM and CSIRO-led study reports due for public release by end of July. The Earth Observation Roadmap is due for release in the latter part of 2021.

Feedback from consultation was used to inform and progress the Agency's Robotics and Automation Roadmap on Earth and in Space. Pathways for developing competitive capabilities are being finalised.

Development of the Space Situational Awareness Roadmap continues, with content currently in review for publication. There are ongoing discussions with Defence regarding a national SSA strategy (focused on dual civil and military responsibilities and activities).

In late 2020, an additional roadmap for Space Medicine and Life Sciences was added to the Technology Roadmaps program. Feedback from consultation was used to inform and progress this roadmap, which aligns with the Agency's Moon to Mars initiative. Identified activities and opportunities are being used to shape and finalise 10-year targets and pathways for developing competitive space medicine and life sciences capabilities.

# House of Representatives Inquiry into Developing Australia's Space Industry

On 11 November 2020, the House of Representatives Standing Committee on Industry, Innovation, Science and Resources commenced an inquiry into Developing Australia's Space Industry, focussing on how the Australian Government can support and encourage the space industry while preserving and protecting the space environment. Public hearings have been held in Canberra, Adelaide, Sydney, Armidale and Brisbane. A series of site visits has also been undertaken. A number of companies provided formal submissions to the Inquiry, including proposed changes to the legislation, and cost recovery. The Agency's Deputy Head appeared at the Canberra hearing and the Agency Head in Adelaide.

The Agency led a DISER joint submission to the Inquiry in January 2021, which included input across the portfolio, and from the Department of Defence; Department of Foreign Affairs and Trade; and Department of Infrastructure, Transport, Regional Development and Communications and their portfolio agencies.

Since its initial submission to the Inquiry, the Agency has been providing evidence and executive support, and conducting ongoing analysis and tracking of public submissions. It is expected that recommendations from the report will inform Government consideration of the statutory basis for the Agency.

In March 2021, the Bureau of Meteorology provided a submission to the Inquiry. In the submission the Bureau articulated the value and importance of satellite data to the Bureau's operations, and expressed its support of growing capabilities in the Australian space industry.

## Bushfire Earth Observation Taskforce

In January 2020, the Agency established the Bushfire Earth Observation Taskforce, in partnership with CSIRO, GA and the Bureau of Meteorology. The Taskforce delivered its report to the Minister in early June 2020 and the Agency appeared before the Senate Inquiry on lessons to be learned in relation to the Australian bushfire season 2019-20, in late July 2020. The Agency also gave evidence to the Royal Commission into National Natural Disaster Arrangements in early August 2020 and the Taskforce Report was provided to the Commission. The [Report](#) was released by the Agency on 7 December 2020.

Activities continue with CSIRO, Geoscience Australia and Emergency Management Australia in regards to the next steps. Recommendations from the Taskforce Report are being incorporated into the Earth Observation Roadmap activities.

## State and Territory Engagement

Engagement with the States and Territories provides an important mechanism for the Agency to understand the opportunities for the space sector across Australia. The Agency holds monthly meetings with each State and Territory government, in addition to the quarterly State and Territory Space Coordination meetings, and is consulting with them and industry on the Technical Roadmap development. Since becoming Head of the Australian Space Agency, Mr Palermo has committed to engaging with the States and Territories, as well as with key industry, research and government stakeholders, in an effort to understand their requirements and expectations.

The Agency holds monthly meetings with each State and Territory government, in addition to the quarterly State and Territory Space Coordination meetings.

On 23 July 2020 the Head of the Agency signed a MOU with the Northern Territory in a virtual signing ceremony with the NT Chief Minister. The MOU highlighted some of the geographical strengths of the Territory and opportunities for commercial launch, stratospheric ballooning and satellite ground stations.

On 28 June 2021, the Agency signed a Memorandum of Understanding with the Queensland Government. This MOU focuses on supporting industry and leveraging the existing start-up ecosystem, as well as collaborating with government and developing skills and workforce capability.



*Figure 9 - Virtual MOU signings between the Australian Space Agency and (L-R.) the Northern Territory and Queensland*

The States and Territories have been active across the 2020-2021 period in developing their own space plans, of which the following represent a few examples:

- The Queensland Government announced plans to conduct a technical and environmental analysis of a potential launch facility at Abbot Point, near Bowen QLD. This report was delivered in May 2021 and approved Abbot Point as a launch site for some smaller launchers.
- In January 2021 the South Australian Government announced a joint initiative with industry to send a locally manufactured small satellite to low Earth orbit. The SmartSat CRC will lead the mission and application prototyping.
- On 29 January 2021 the Western Australian Government announced a \$500,000 investment to support Curtin University's Binar Space Program.
- The NSW Government's Space Industry Development program has funded the Waratah Seed mission to deliver a 6U CubeSat platform providing spaceflight opportunities in LEO for Australian companies to space qualify potential commercial technologies.

## Industry Engagement

The Agency continues to engage with industry in order to understand its requirements and assist the Australian space industry to grow in line with its mandated purpose. The Agency meets regularly with stakeholders, including:

- Quarterly Space Industry Leaders Forum meetings;
- Engagement with national organisations and industry bodies including ACMA, CSIRO, SIAA, Austrade, and SmartSat CRC

The Agency holds one-on-one engagement with stakeholders, and seeks feedback into Agency activities. It also holds regular meetings with international counterparts and agencies. The Agency works with other national organisations to support start-up growth and export, including:

- CSIRO Space 2.0 workshops. These workshops support opportunities for Australian space start-ups and SMEs to develop research and business collaborations with CSIRO, the wider research sector, aerospace primes, and space

technology end-users. The 5th workshop, held 7-8 October 2020 in conjunction with the Australian Space Agency, specifically targeted opportunities in space for the manufacturing sector.

- Austrade Workshops and Digital Events such as those under the UK-Australia Space Bridge. These include: 8 Space Bridge State & Territory capability roadshows (ran from May 2020 to July 2020); the Australia Korea Space Forum (July 2020); AU-NZ-Canada Space Industry Roundtable (October 2020)

Industry input has been extensively sought during the development of the Agency's Technical Roadmaps.

The Agency encourages industry innovation by supporting domestic and international competitions, for example:

- The global Gravity Challenge, an initiative of Deloitte, which aims to bring together end-users, data providers and innovators to solve pressing economic, social and environmental problems.
- The Maxar Spatial Challenge is aimed at promoting the value of space derived intelligence in addressing key challenges identified by stakeholders within Australia; identifying and supporting key innovators within Australia that can leverage space intelligence and address key challenges; and developing sustainable solutions that can be scaled and applied on a regional or national level.
- The multi-agency Global Business and Talent Attraction Taskforce is working with the ASA to identify and attract key high-yield businesses and exceptionally talented individuals to Australia whose ideas, networks and capital will build Australia's ecosystems of knowledge and innovation in space, and support the growth of Australia's space capabilities. This collaboration will be supported by the release of a global strategic communications campaign to attract experts within the space sector to Australia.

## Australian Space Forum

The 10<sup>th</sup> Australian Space Forum was held as a virtual event on 25 November 2020. Supported by the Australian Space Agency and SmartSat CRC, the Forum attracted over 1200 registrations and included speakers from across Australia, Japan, the United States and the United Kingdom. Notable events at the Forum included:

- The launch of the South Australian Growth State Space Sector Strategy
- Launch of the Andy Thomas Space Foundation, which will support space education activities and other initiatives, including the Australian Space Forum
- The announcement of the Defence Science and Technology Group's Next Generation Technologies Fund
- The University of Adelaide announcing the establishment of The Andy Thomas Centre for Space Resources – spearheading the optimisation of sustainable use of off-Earth resources

The 11<sup>th</sup> Australian Space Forum was held in Adelaide on 31 March 2021 and coincided with the official opening of the Australian Space Discovery Centre. Supported by the Australian Space Agency, the South Australian Space Industry Centre and SmartSat CRC, it was the first Forum managed by the Andy Thomas Space Foundation. Over 1000 delegates attended the Forum, which was held as a hybrid event, with face-to-face and virtual attendance to accommodate those unable to travel to South Australia.

Over 150 students registered for the Space Passport Sessions at the Forum. These sessions provided secondary and university students the opportunity to learn about space careers directly from companies involved with the Australian space sector.



Figure 10 - Australian Space Agency booth at the 11<sup>th</sup> Australian Space Forum, 31 March 2021

The day of the forum was also the centenary of the Royal Australian Air Force (RAAF). Chief of the Air Force, Air Marshal Mel Hupfeld, chose the day to announce that the RAAF would plan to establish a ‘space command’ in collaboration with the Army and the Navy, given the growing global competition for supremacy in LEO and beyond.

## Defence Investment in Space

The *2020 Defence Strategic Update* and *2020 Force Structure Plan* outline a strategy for Defence and the capability investments needed to deliver it. They will ensure that Defence can respond to new challenges as they emerge and deliver on the Government’s commitment to defend Australia and its interests.

The *Defence Strategic Update* sets out the challenges in Australia’s strategic environment and their implications for Defence planning. It provides a new strategic policy framework: shape our environment; deter actions against our interests; and, when required, respond with military force.

The *Force Structure Plan* details the Government’s intentions for new and adjusted Defence capability investments to implement these new strategic objectives set out in the *Defence Strategic Update*.

The Government recognises space as its own operational domain, and will enhance Defence’s space capabilities to provide Australia with assured access to space and help advance our national interests.

In late 2020 Defence commenced a Space Domain Review to be conducted over a two-year period to develop a strategy for the Defence Space Domain. The review will determine the functions required of the Space Domain and the optimal Defence organisational structure and resourcing that would support the transition to a more integrated, efficient and effective Defence Space organisation, more effectively managing space as an operational domain. In May 2021, Defence announced the selection of [Air Vice-Marshal Cath Roberts as the inaugural Head of Defence Space Command](#).

Defence is progressing the roll out and delivery of the *More Together Defence Science and Technology Strategy 2030*, released in 2020. This includes the establishment and scoping of the [Resilient Multi-mission](#)



[Space Science Technology and Research Shot project](#) to align Defence's strategic space research to force structure priorities.

Defence is investing in space capabilities and strengthening its international partnerships to reflect its space operations. Investments of around \$7 billion in space capabilities over the next decade, including sovereign-controlled satellites, will improve Defence's resilience and enhance a number of space-dependent capabilities across the joint force through providing assured access to these space services when needed.

Defence will continue working to integrate more closely with the United States and other likeminded partners and allies to enhance our space capabilities and coordinate efforts in space defence. This includes both bilateral and multilateral relationships.

Defence is also investing in space research and innovation aligned to Defence's highest priority needs in space. This will generate opportunities for exploring concepts and developing sovereign space capabilities, including directly with Defence or through initiatives such as the SmartSat CRC where Defence is a core member.

## Defence and National Security

Australia's space businesses deliver a wide range of products and services that touch on all areas of the economy. Many of these technologies and services are 'dual-use', meaning they support defence capability as well as civil capability. The Agency is committed to transforming and growing our civil space industry, and recognise that this can also support the Defence sector. To achieve its purpose to grow Australia's space industry, the Agency has developed a close working relationship with the Department of Defence. Air Vice-Marshal Catherine Roberts, the incoming Commander Defence Space Command is a member of the Australian Space Agency Advisory Group. Professor Tanya Monro, Chief Defence Scientist is also a member of the Space Industry Leaders Forum, which keeps the Australian Space Agency informed on industry relevant issues and provides a coordination point for the civil space sector. These links ensure alignment between Australia's civil and Defence-related space activities, and that our efforts to support the growth of the sector are complementary.

Defence is working with the Australian Space Agency and industry to transform the way the ADF operates in space, across the joint force. Space is identified as a critical new capability in the *2020 Defence Strategic Update* date. The Agency will continue to work closely with Defence on access to space, satellite-based capability and services, space situational awareness and the delivery of real-time communications and position, navigation and timing information.

The Agency has actively engaged with the Department of Defence during the development of the Technical Roadmaps and continues to engage in other ways. For example, the Head of Agency supported the Chief of Army symposium in April 2021 and a Defence Service Attaché Advisory Group (SAAG) visited the Australian Space Discovery Centre on 21 May 2021.

As the effects of the COVID-19 pandemic on our economy become more apparent, Australia's prosperity and security is increasingly important. The Agency is working with a range of Government agencies in relation to critical and sensitive technologies, for example in relation to the movement of sensitive technologies and goods used in Australia's civil space activities. The Agency continues to support a range of cross Government policy initiatives, such as the implementation of reforms to the *Security of Critical Infrastructure Act 2018*, being led by the Department of Home Affairs.



The Agency provides support to National Security Space IDC, which examines civil space issues that intersect with national security. The committee will consider policy settings relating to space ground stations, including in regard to Critical Infrastructure reforms led by Home Affairs.

Across the SCC membership, there are a number of national security initiatives.

*Table 4 – SCC National security activities*

Organisation	Summary of activity
Bureau of Meteorology	<p>The Bureau’s ionospheric forecasts support defence communications, and defence radar operations.</p> <p>The Bureau’s Space Weather Services provides expert advice on the risk assessment of space weather impacts on Australia’s critical infrastructure.</p>
CSIRO	<p>CSIRO cooperates with Defence Science and Technology Group in a number of space-related areas including space situational awareness, Earth observation, communications technologies, materials and manufacturing, and CubeSat technologies.</p>
Department of Defence	<p>The vast majority of Defence’s activities outlined in this report are national security related.</p> <p>The 2020 Defence Strategic Update and 2020 Force Structure Plan, released on 1 July 2020, outline a new strategy for Defence and the capability investments needed to deliver it. Further information can be found on the <a href="#">website</a>. The Defence Strategic Update sets out the challenges in Australia’s strategic environment and their implications for Defence planning. It provides a new strategic policy framework to ensure Australia is able – and is understood as willing – to deploy military power to shape our environment, deter actions against our interests and, when required, respond with military force.</p> <p>The 2020 Force Structure Plan details the Government’s intentions for new and adjusted ADF capability investments to implement the new strategic objectives.</p> <p>The 2020 Defence Strategic Update and the 2020 Force Structure Plan will ensure that Defence can respond to new challenges as they emerge. This delivers on the Government’s commitment to protect Australia and its interests. Space is highlighted as its own domain. The strategic steps and investments the government will take regarding the space capabilities Defence will need to provide Australia with assured access to space and help advance our national interests in space are outlined in both documents.</p>
Department of Foreign Affairs and Trade	<p>DFAT co-chairs with Defence the National Security Space Inter-Departmental Committee (NSS IDC), which coordinates national security advice on civil space issues.</p> <p>DFAT has engaged with a range of bilateral partners on space security and disarmament issues.</p> <p>To keep Australians safe and secure, the department works with partners to tackle security threats and build support for strong international rules and norms that protect Australian interests.</p> <p>DFAT continues to work with like-minded nations in multilateral fora including UNCOUOS to promote the peaceful and sustainable use of space.</p> <p>DFAT continues to promote Australia’s national interests in the space domain – complementary but distinct to those of our international partners – founded on our pursuit of the reduction of space threats to our security, and our reputation as a credible international partner that takes its obligations seriously.</p>
Department of Home Affairs	<p>In August 2020, the Department of Home Affairs released Australia’s Cyber Security Strategy 2020 which outlines an investment of \$1.67 billion over ten years to create a more secure online world for Australians and their businesses.</p> <p>The Department of Home Affairs will work with Five Eyes partners, the Bureau of Meteorology and other experts, to contribute to the drafting of a Space Weather Action</p>

Organisation	Summary of activity
	<p>Plan for Australia’s infrastructure which will form part of the Australian Government Crisis Management Framework administered by Department of Prime Minister and Cabinet.</p> <p>The amended <i>Security of Critical Infrastructure Act 2018</i> (Cth) define a number of regulatory and non-regulatory mechanisms designed to support the states and territories and industry to address critical infrastructure vulnerabilities, including for the space sector. These measures set out how the Australian Government will work with critical infrastructure entities of all levels of maturity to enhance the security and resilience of critical infrastructure.</p> <p>The Cyber and Infrastructure Security Centre (CISC), through the Trusted Information Sharing Network (TISN), will convene an exercise with participants from the space sector focusing on a severe space weather warning.</p> <p>The CISC will work with partners across both government and industry to develop a risk assessment on the space sector to identify relevant threats and offer mitigations, where possible.</p> <p>The Critical Infrastructure Program for Modelling and Analysis (CIPMA) is responsible for providing data driven and evidence-based reporting on critical infrastructure interdependencies. CIPMA is also responsible for establishing up to date information on cross sector interdependencies and flow on impacts, including solar events and direct, secondary and tertiary impacts.</p> <p>The Department of Home Affairs is also responsible for policy related to the security of critical and emerging technologies, and is working across government to lift the security of technologies that will be critical to the national interest.</p>
<p>Department of Infrastructure, Transport, Regional Development and Communications</p>	<p>DITRDC is working closely with government security agencies to manage the challenges presented by the interaction of drones and space activities to ensure the resilience of satellite-enabled emerging and future aviation technologies.</p>

## Space Capability Activities Supporting the Australian Civil Space Priority Areas

The National Civil Space Priority Areas are outlined in the *Australian Civil Space Strategy 2019-2028*. They also support the CSIRO Space Roadmap, published in 2018 and the Global Exploration Roadmap from the International Space Exploration Coordination Group.

A summary of activities by the SCC membership is outlined below under each Priority Area.

### Communications Technologies and Services

*Space is crucial for communications on land, our marine jurisdiction, and airspace. Australia can play a lead role in emerging technologies such as lasers for data communication, quantum technologies for secure communication, and hybrid radio and optical communications.*

Australia’s most extensive space activity has traditionally been in communications technologies and services; for example, with the NASA Agreement with CSIRO to manage the Canberra Deep Space Communication Complex, as well as private sector investment in satellite based television and internet services.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 2 (2019-2021). The *Communications Technologies and Services Roadmap 2021-2030* was released on 22 December 2020, providing the strategic direction to capture opportunities to grow the industry.

Table 5 – SCC Communications technologies and services activities

Organisation	Summary of activity
<p>Australian Antarctic Division</p>	<p>To support the Australian Antarctic Program, the Australian Antarctic Division (AAD) has increased its use of Low Earth and Medium Earth orbit satellite services for Southern Ocean and Polar communications. This includes new satellite services to augment current satellite communications on vessels and new Satellite services for Traverse Capability. Future plans include new C-Band satellite services at Wilkins Aerodrome and for the RSV Nuyina icebreaker.</p>
<p>Australian Communications and Media Authority</p>	<p>ACMA manages access to the radiofrequency spectrum through the development and maintenance of a regulatory framework for satellite services in Australia, and through licensing of space services. It represents Australia's space spectrum management interests internationally, including filing and coordination of Australian satellite systems with the ITU, and providing operational support for Australian-filed satellite networks.</p> <p>The ACMA's space-related activities for 2020–21 are detailed in the Five-Year Spectrum Outlook (FYSO): 2020-24 <a href="#">annual progress report</a>. Key developments include:</p> <ul style="list-style-type: none"> <li>• Completion of a review of the 2 GHz band with a decision to re-plan the band for mobile-satellite services</li> <li>• Improved pricing arrangements for satellite services through price reductions of 50 to 90 per cent for most apparatus licences operating above 5 GHz, as well as introduction of a 'systems price' for co-located earth stations authorised under the same licence.</li> <li>• Amendments to the Foreign Space Objects Determination to include 6 new operators seeking to provide satellite-based communication services to Australia: Astrocast SA (Switzerland), Fleet Space Technologies Pty Ltd (Australia), Hiber B.V. (Netherlands), Kinéis SAS (France), O3b Limited (Jersey) and Viasat, Inc. (United States).</li> </ul> <p>The ACMA's future work priorities for the next five years are also outlined in the annual FYSO, which includes a detailed work plan for the forthcoming financial year. Public consultation on the <a href="#">draft FYSO 2021–26</a> closed in April 2021. The <a href="#">final document</a> is expected to be released later in 2021.</p>
<p>Bureau of Meteorology</p>	<p>To meet its needs for real time satellite observations, the Bureau owns and operates a continental-scale direct reception network including two sites in Antarctica.</p> <p>As space weather impacts upon communications services, the Bureau's Space Weather Services (SWS) provides a broad range of space weather services associated with measuring, modelling, and forecasting the near space environment. The SWS supports defence, navigation, aviation, resource exploitation and other industries.</p> <p>SWS operates a World Data Centre, titled WDC – Space Weather, Australia, which is a member of the International Council for Science World Data System (ICSU-WDS).</p> <p>In the first quarter of 2021, the Bureau released the Australian Space Weather Alert System (ASWAS). The alert system has been developed to communicate space weather conditions and their possible effects on Australian industry sectors and the community. It also outlines mitigating actions that can be taken by operators and decision-makers in response to the alert thresholds.</p> <p>The Bureau's ground stations at Crib Point (VIC), Darwin (NT), and Casey and Davis stations (Antarctic) have been upgraded and are capable of receiving data from the USA's Joint Polar Satellite System-2 (JPSS-2) mission when it is launched in 2022. JPSS-2 will carry instruments that are critical for use in the Bureau's weather model, and also includes the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument used for land and ocean colour applications.</p>

Organisation	Summary of activity
CSIRO	<p>The Canberra Deep Space Communication Complex (CDSCC), operated by CSIRO for NASA, provides two-way communications and control between the Earth and spacecraft, for around 30 space missions, reaching out as far as the Voyager spacecraft.</p> <p>CSIRO manages the Australian Tracking and Data Relay Satellite (TDRS) facility at Yarragadee WA, and the TDRS monitoring facility and scientific balloon launching station at Alice Springs on behalf of NASA.</p> <p>CSIRO provides operational support and maintenance for the ESA deep space tracking station at New Norcia, WA.</p> <p>In March 2021 CSIRO signed a five-year agreement with Houston-based aerospace company Intuitive Machines to support multiple lunar missions, including their first flight under NASA's Commercial Lunar Payload Services (CLPS) initiative. The CSIRO facilities providing communications support include the Parkes radio telescope, which also supported NASA's Apollo Moon landings.</p> <p><b>Operation of space tracking facilities</b></p> <p>CSIRO continued to manage the CDSCC on behalf of NASA. Highlights in 2020-21 included:</p> <ul style="list-style-type: none"> <li>• tracking the Japanese Hayabusa2 spacecraft in the lead up to, and post, the successful asteroid (Ryugu) sample capsule release and ground recovery in the Woomera Prohibited Area in South Australia in the early hours of 6 December 2020</li> <li>• supporting the Mars2020/Perseverance Rover mission, which launched in July 2020 and landed on Mars in February 2021, followed by the first flight of the Mars Helicopter, Ingenuity, in April 2021</li> <li>• supporting the launch of the Emirates Mars Mission in July 2020 and its successful entry into Mars orbit in February 2021</li> <li>• supporting the NASA OSIRIS-REx mission touch-and-go on asteroid Bennu in October 2020 which successfully collected a large sample of asteroid material to be returned to Earth in 2023</li> <li>• completion in Feb 2021 of a major 11-month overhaul of CDSCC's 70m antenna (DSS-43), the largest steerable antenna in the Southern Hemisphere, to enable the continued operation of this key Deep Space Network (DSN) asset for many decades to come</li> <li>• transmission of critical commands to the distant Voyager 2 spacecraft in October 2020 using DSS-43, which is the only antenna world-wide capable of commanding the spacecraft due to Voyager 2's location and extreme distance from Earth</li> <li>• implementation of changes to enable uninterrupted operations of the DSN network, including providing assistance to other DSN sites (USA and Spain), in response to the COVID-19 pandemic.</li> </ul> <p>CSIRO continued to provide operations and maintenance support for the ESA deep space tracking station at New Norcia, WA. Highlights in 2020-21 included:</p> <ul style="list-style-type: none"> <li>• supporting the Vega VV16 launch Sept 2020, the first European mission to launch multiple (53) small satellites, with the 4.5m New Norcia Antenna 2 (NNO2)</li> <li>• supporting the Bepi-Columbo Venus Flyby en route to Venus (Oct 2020) with the 35m New Norcia Antenna 1 (NNO1).</li> </ul>

Organisation	Summary of activity
	<p>The Breakthrough Prize Foundation continues to use CSIRO’s 64m Parkes radio telescope in eastern Australia to search for extra-terrestrial intelligence through a multi-year agreement.</p> <p>CSIRO contributed technical coordination expertise to the <i>Communications Technologies and Services Roadmap</i> in partnership with the Australian Space Agency.</p> <p><u>Quasar Technologies</u></p> <p>In May 2021 CSIRO announced the launch of Quasar Satellite Technologies Pty Ltd, a spin-out company developing technology for the satellite ground communications market derived from phased array technology developed by CSIRO for radio telescopes like the Australian SKA Pathfinder (ASKAP) telescope in Western Australia.</p>
Department of Foreign Affairs and Trade	<p>DFAT leads on ground station policy, working with the Agency to develop an understanding of the regulatory and administrative framework governing ground stations in Australia.</p>
Department of Defence	<p>The majority of current Defence satellite communications capability has been delivered through the various phases of Joint Project 2008. Augmented anchoring at Satellite Ground Station-West in WA, Satellite Ground Station-East in NSW, and the implementation of a satellite communications Network Management System remain to be completed.</p> <p>Joint Project 9102 Phase 1 – the Australian Defence Satellite Communications System received ‘first pass’ government approval in June 2020. The project aims to deliver a sovereign controlled Wideband and Narrowband Satellite Communications (SATCOM) system over the Indo-Pacific region with global access through sharing arrangements with international partners and supplementation through commercial satellite communications contracts. A request for tender was released in April 2021, closing in October 2021. Subject to outcomes of the tender process, initial operational capability is anticipated towards the end of the decade. Australian Industry opportunities will be solution dependent but are likely to be in the control system, operational support, sustainment and facilities.</p> <p>\$50 million over 15 years has also been identified to support Australian innovation and research in technologies to support future phases of the project. The Australian Space Agency assisted Defence to identify where these opportunities lie, as outlined in the Communications roadmap. Joint Capabilities Group and DSTG led and made contributions to the Agency’s Communications Technical Advisory Group that developed the Communications Technologies and Services Roadmap.</p> <p>A key technology is the development of optical communication capability, which can be more secure and support high data rates. Defence also requires resilient satellite communication and is leading the development of hybrid Radio Frequency/Optical communication technology through the SmartSat CRC’s Compact Hybrid Optical-RF User Segment (CHORUS) project.</p> <p>The management of communications in a contested environment is also being assisted by DSTG investigating machine learning and other data science techniques for anomaly detection and system optimization.</p> <p>DSTG continues to contribute to the International Small-Satellite Command and Control Network through the Resilient Multi-mission Space Science, Technology and Research (STaR) Shot project.</p>
Department of Home Affairs	<p>The Department of Home Affairs supports the assessment of national security risks arising from foreign investment in ground stations in Australia. The Critical Infrastructure Centre (CIC) may receive requests as part of the Foreign Investment Review Board process administered by Treasury, or may proactively seek to conduct vulnerability assessments within this sector.</p>

Organisation	Summary of activity
<p>Department of Infrastructure, Transport, Regional Development and Communications</p>	<p><u>International Radiocommunications</u></p> <p>DITRDC leads Australia’s engagement in key international radiocommunications policy-making fora discussing WRC-23 agenda items. These agenda items deal with issues relating to a range of communications technologies and satellite services, including a possible new allocation to the aeronautical mobile satellite (route) service, possible regulatory actions related to the Global Maritime Distress and Safety System (GMDSS) and conducting studies on satellite-to-satellite links in a number of frequency bands.</p> <p>AMSA continues to contract Inmarsat (expires 30 June 2022) and Iridium (expires 31 December 2024) to provide Australia’s satellite-based GMDSS services.</p> <p>Australia is an active participant in the Cospas-Sarsat satellite-based distress beacon detection system. AMSA operates a satellite tracking station near Mingenew, Western Australia, and the Mission Control Centre (MCC) in Canberra, which processes distress beacon data for forwarding alerts to fifteen countries.</p> <p><u>NBN Co Sky Muster satellite services</u></p> <p>The NBN Co Sky Muster satellite network provides access to fast broadband to around 427,000 homes and businesses, predominantly in regional, rural and remote Australia. As of 30 June 2021, 111,630 homes and businesses had an active NBN Co Sky Muster satellite service.</p> <p>Since 2016, NBN Co has continually developed its range of wholesale satellite products to better meet the needs of homes and businesses. This included enhancing existing services by increasing data allowances and releasing new products and additional applications to enable remote telehealth and distance education.</p> <p>In response to COVID-19, from the end of March 2020, NBN Co provided satellite broadband retailers with temporary access to an additional 45 Gigabytes of download data for each standard Sky Muster plan. This arrangement ended at the end of March 2021.</p> <p>NBN Co’s Sky Muster Business Satellite Service (BSS) enables access to business grade internet, data and voice services for eligible business customers in rural and remote Australia, and is aimed at medium to large businesses. The service launched in October 2019 and was initially available in 58 of the 101 Sky Muster beams.</p> <p>On 25 March 2021, NBN Co announced plans to expand its BSS beam coverage from 93 per cent coverage to 100 per cent of the Australian mainland as well as surrounding large islands from mid-2021. NBN Co also announced it would reduce the wholesale price by approximately 40 per cent for the BSS Access Bandwidth Service Level 3 dedicated bandwidth product, which delivers high data performance for enterprise and government customers.</p> <p>These improvements will give businesses across Australia cheaper access to dedicated capacity and wholesale speeds of up to 50/13 Mbps, and also provide the option of unlimited data to provide core connectivity required for critical business applications. NBN Co is continuing to work on developing other satellite products that will meet specific business needs.</p> <p><u>Satellite communications</u></p> <p>Airservices provides point-to-point satellite communications for the aviation sector via a service provider. Airservices is exploring opportunities to define and test new space-based VHF and Automatic Dependent Surveillance – Broadcast (ADS-B) service offerings.</p> <p>Airservices recognises shifting from ground-based to space-based communication, surveillance and navigation systems provides opportunities to enhance safety and efficiency while also reducing costs and is exploring these opportunities.</p> <p><u>Regional Telecommunications Review</u></p>



Organisation	Summary of activity
	<p>The Regional Telecommunications Review (the Review) is an opportunity for people living and working in regional, rural and remote areas of Australia to share their views and experiences using telecommunications services in their area.</p> <ul style="list-style-type: none"> <li>• Every three years the Regional Telecommunications Independent Review Committee (the Committee) is appointed to conduct the review. Its reports are important in setting the regional communications policy agenda in the following years. The Committee is established and conducts its review under Part 9B of the Telecommunications (Consumer Protection and Service Standards) Act 1999.</li> <li>• The 2021 Committee was announced by the Hon Mark Coulton MP on 2 June 2021. The Review will be held from June to December 2021. The five members appointed to the Committee are the Hon Luke Hartsuyker (Chair), Ms Sue Middleton, Ms Kristy Sparrow, Professor Hugh Bradlow and Mr Michael Cosgrave.</li> <li>• The Review will examine the adequacy of telecommunications services in regional, rural and remote Australia. It will also consider particular issues identified in the Terms of Reference, including the impact of Government policies and programs, insights from COVID-19, emerging technologies, service reliability, regional development, and improving coordination between tiers of government.</li> <li>• The Committee has been asked to deliver its report to the Australian Government by 31 December 2021 or earlier. The Committee may make recommendations to the Government, to which it must respond.</li> </ul> <p><u>Access to voice and broadband services</u></p> <ul style="list-style-type: none"> <li>• The Universal Service Obligation (USO) provides voice services continue to be available from Telstra where they cannot be supported by the NBN, particularly in NBN Co's satellite footprint.</li> <li>• Access to broadband is underpinned by the statutory infrastructure provider (SIP) laws, which took effect from 1 July 2020. NBN Co is the default SIP for Australia. Beyond NBN Co, there are other carriers which are SIPs, for example, where they have been contracted to service an area such as a new development.</li> <li>• SIPs must connect premises to their networks on reasonable request from a retail provider, and must supply wholesale services that allow retail providers to supply retail broadband services with peak download speeds of at least 25 Mbps and peak upload speeds of at least 5 Mbps.</li> <li>• On fixed-line and fixed wireless networks the wholesale services SIPs supply must also be able to support retail voice services.</li> <li>• While giving preference to the delivery of services by fixed line infrastructure, the SIP regime does include the provision of services by satellite where appropriate.</li> <li>• The ACMA maintains a register of SIPs and their service areas.</li> <li>• The Telecommunications (Statutory Infrastructure Providers—Circumstances for Exceptions to Connection and Supply Obligations) Determination 2021 determines limited circumstances where SIP connection and supply obligations do not arise.</li> <li>• During 2020-21, the Department also consulted on potential Ministerial standards, rules and benchmarks with which SIPs must comply.</li> <li>• DITRDC continues to monitor and assess ways to deliver quality telecommunications services in a more cost-effective way that can meet consumer needs. This includes the ability of new space technologies.</li> </ul>

Organisation	Summary of activity
	<ul style="list-style-type: none"> <li>In early 2021, the Government made announcements that it had awarded six Alternative Voice Services Trials (AVST) grants to Concerotel, NBN Co, Optus, Pivotel, Telstra and Zetifi to deliver trial services in different rural and remote locations across Australia. The trial services typically involve new applications of technologies like wireless and satellite.</li> </ul> <p><u>Viewer Access Satellite Television Service</u></p> <p>The Viewer Access Satellite Television (VAST) service provides free-to-air television and radio broadcasts to over 210,000 households and 30,000 travellers that are unable to access television through the usual terrestrial transmissions. These viewers are mostly in regional and remote areas, but VAST also provides a service to metropolitan areas where terrestrial transmission services are not available. DITRDC administers the funding provided to commercial broadcasters towards the satellite transmission of commercial free-to-air television services over VAST, with ABC and SBS funded via their Budget appropriations.</p>
Geoscience Australia	<p>GA commissioned a new 3 metre antenna at the satellite ground station at Alice Springs along with several upgrades to power systems, servers and data storage. These improvements will ensure the site maintains the high availability required to meet the 98% success rate for scheduled satellite passes into the future.</p> <p>The ground station now hosts four antennas with the two 9 metre antennas being certified Landsat Ground Network (LGN) assets for Landsat 7 and 8. Testing for Landsat 9 is continuing ahead of certification and the satellite launch in September 2021.</p> <p>GA co-chaired the Australian National Ground Segment Technical Team (ANGSTT) during 2020-21. This group was established to provide a way for several groups that operate ground infrastructure to collaborate and to provide access to satellite data, share knowledge and coordinate technical expertise within government. Through this team, agencies and state governments coordinate development and use of Earth observation satellite ground stations. Participants include GA, Bureau of Meteorology, Landgate, CSIRO and the Agency.</p> <p>In 2020 GA led work towards using the Japanese Quasi Zenith Satellite System (QZSS) to conduct an Emergency Warning Service (EWS) pilot. This trial has focussed on bushfire and tsunami warnings with a particular emphasis on exploring message incorporation on the available signal bandwidth, and the spatial coverage extent of the messages. A series of tests were conducted, including field trials in NSW with simulated emergency events that would require fast response. Field-tests were successful in receiving and decoding EWS messages using provided QZSS receivers and a newly developed Android-based mobile app. The mobile app was developed by the research teams at RMIT and UNSW universities for the purposes of this trial.</p> <p>The successful outcome of this trial indicates that satellite-based EWS could be further developed to meet the needs of the Australian Emergency Management community and play a complementary role to telephony emergency warning services.</p>

## Case study: Compact Hybrid Optical-RF User Segment (CHORUS)

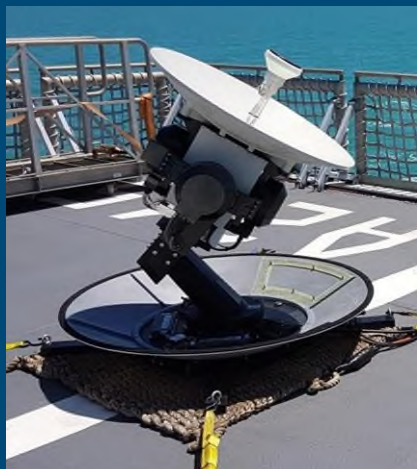


Figure 11 – Phase 1 CHORUS satellite terminal combining radio and optical frequency capabilities

This project under the SmartSat CRC is led by Defence Science and Technology Group and involves EOS Space Systems, EM Solutions, Australian National University, University of South Australia, Shoal Group, and Lyrebird.

Phase 1 of Project CHORUS was established as a high-risk, high-payoff research activity to develop concepts for a highly integrated, tactical satellite communications terminal that combines radio frequency and optical frequency capabilities into a single compact terminal. During Phase 2 the project will develop an engineering model of CHORUS capable of demonstrating core technologies that can be used to advance other areas of interest across the Cooperative Research Centre including cognitive communications, optical communications, and satellite-based laser terminals as a minimum set. This project is an excellent example of collaborative research across industry, academia and government.

## Space Situational Awareness and Debris Monitoring

*Collisions in space with debris pose a risk to assets and life. Australia's geographical position makes it an ideal location for space debris tracking and space traffic management activities. Space Situational Awareness (SSA) assists with the management of orbital resources, ensuring that orbits which are valuable for space-based services remain available for use.*

The *Space Activities Amendment (Launches and Returns) Act 2018* includes the requirement for a debris mitigation strategy for certain authorisations involving objects going to space. The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 3 (2021-2028). Development of a Space Situational Awareness roadmap is currently being undertaken.

Table 6 – SCC Space situational awareness and debris monitoring activities

Organisation	Summary of activity
Bureau of Meteorology	<p>The Bureau of Meteorology Space Weather Services is a member of the Australian Space Agency SSA Technical Advisory Group and is contributing its space weather expertise to the development of the Space Agency's Space Situational Awareness 10-year roadmap.</p> <p>The Bureau's SWS is using near real-time COSMIC-2 profiles of ionospheric electron density to improve its modelling of the Earth's ionosphere, a key component of the geo-space affecting the orbits and survival of Low Earth Orbit (LEO) satellites.</p> <p>The Bureau also provided space weather support intelligence for the Commercial Sprint Advanced Concept Training (SACT) events. The SACT is an international exercise series which was established in 2019 to advance joint space operations. As part of the Pacific cell operations, the Bureau provided space weather briefings to the participants to support the operations.</p> <p><u>Responsive Space Operations Centre (RSOC)</u>: In January 2021, the Bureau of Meteorology signed an agreement with Saber Astronautics to provide space weather information to the mission control centre located within the Australian Space Discovery Centre. Through</p>

Organisation	Summary of activity
	<p>this agreement Bureau provides real-time space weather information to the Responsive Space Operations Centre (RSOC).</p> <p>Collaboration between the Bureau's Space Weather Services team and Saber has informed the design of a range of suitable forecast, alert and warning products for Saber's unique control platform. Through the Bureau, the RSOC now has direct access to integral space weather information, essential for the safe management and operation of satellites in near earth orbit.</p> <p>This partnership provides the opportunity to develop novel space environmental intelligence products to help position the rapidly growing Australian space industry at the forefront of efficient spacecraft operations.</p>
CSIRO	<p>Asteroids emerging from the southern hemisphere, which account for 5–10 per cent of all near-Earth asteroids, are not immediately detectable by the international NASA Near Earth Asteroid (NEA) program. Australia is contributing to this NASA program as well as developing new science to assist future space exploration missions by combining the capabilities of CDSCC (DSS43) and the Australia Telescope National Facility (Compact Array and Parkes radio telescopes) to perform bistatic radar tracking of asteroids. Since 2015 CSIRO, in collaboration with NASA JPL, has demonstrated the successful detection and tracking of sixteen near-Earth objects using exclusively Australian-based systems. This includes a human made object, 2020 SO (spent rocket body), and asteroids with diameters of 0.01–2 km at ranges of 0.1 to 20 lunar distances. Over 22-29 Jan 2021, asteroids 2020 WU5, 2020 YE5, 2020 SO and 2020 TB12 were detected in collaboration with NASA JPL.</p> <p>CSIRO participated in the Caltech/JPL Keck Institute Workshop on the Future of Planetary and Asteroid Radar held 11-14 May 2021. The final report will assist NASA planning for extending northern and potentially southern hemisphere deep space radar capabilities.</p> <p>CSIRO contributed technical expertise to the development of the Agency's national Space Situational Awareness Roadmap.</p>
Department of Defence	<p>Defence undertakes Space Domain Awareness (SDA) to provide the ability to identify, characterise and understand factors that affect the space domain.</p> <p>Through Joint Project 9360, Australia is investing in a diverse sensing and command and control system that will provide a sovereign Space Domain Awareness capability while allowing for flexibility to adapt to emerging threats, through an iterative approach to capability management.</p> <p>In Western Australia, the Space Surveillance Telescope moves towards Initial Operational Capability in 2022. This highly advanced telescope will enable the observation and detection of objects in space up to 36,000 km above Earth.</p> <p>Once operational, the Space Surveillance Telescope will join the C-Band Radar jointly operated with the United States, providing object information to the global Space Surveillance Network. The C-Band Radar has been contributing to the Space Surveillance Network since 2015.</p> <p>Complementary to these new capabilities, the Defence Innovation Hub has invested over \$16 million in space domain technologies over the last 24 months and Defence continues to invest in the Smart Satellite CRC as a foundation partner. These early investments in Australian technology advancement are critical to building the foundation of the Australian space industry and Defence.</p> <p>Defence Science and Technology Group (DSTG) is contributing to the Australian Space Agency Space Situational Awareness Technical Advisory Group for development of the Space Situational Awareness Roadmap. For Defence, the key focus segments in this roadmap include: Orbital Object Sensing, System Integration Infrastructure, Data Fusion and Analytics, and Natural Space Environment Monitoring.</p>

Organisation	Summary of activity
	DSTG continues to perform research in the area of SDA, working collaboratively with national and international partners to explore ways to improve Defence's current and future capabilities. This includes the Phantom Echoes activity, working with Canada, New Zealand, the United Kingdom and the United States to demonstrate how allied Space Domain Awareness sensors and processing capabilities can be integrated to enhance their performance over that of individual systems working independently.  Defence Science and Technology Group is participating in a series of SACT activities led by the US Space Force to exercise international industry capabilities for SDA.
Department of Home Affairs	The Critical Infrastructure Program for Modelling and Analysis (CIPMA) maintains awareness of solar weather monitoring, prediction and alerts, space debris monitoring and orbital predictions as they relate to Australia's critical infrastructure.
Geoscience Australia	GA operates the national Satellite Laser Ranging (SLR) Network with stations at Mount Stromlo and Yarragadee contributing to the International Laser Ranging Service (ILRS).

## Position, Navigation and Timing

*Position, navigation and timing (PNT) is critical for many areas of the Australian economy, including agriculture and mining. While Australia does not have its own global navigation satellite system, Australia's PNT infrastructure needs to be world class to underpin the growth of the broader economy.*

The Australian Government has made significant commitments to Australia's PNT infrastructure, which underpins many activities in daily life, as well as a broad spectrum of economic activities. The *Australian Civil Space Strategy 2019-2028* identified this Priority Area as part of Phase 1 (2018-19).

*Table 7 – SCC Position, navigation and timing activities*

Organisation	Summary of activity
Department of Home Affairs	The CIPMA maintains awareness of Industrial Control Systems, Financial Time Stamping and Wide Area communications, and the impact of disruptions to these systems on Australia's critical infrastructure.
Department of Infrastructure, Transport, Regional Development and Communications	<p><u>International radiocommunications</u></p> <ul style="list-style-type: none"> <li>• <b>AMSA</b> is working with New Zealand, and other like-minded countries, to highlight the importance of a Satellite-based Augmentation System (SBAS) for the maritime sector at the International Maritime Organization (IMO). AMSA has supported a European GNSS Agency (GSA) submission to the International Electrotechnical Commission (IEC) for the development of a test standard for marine SBAS receivers.</li> <li>• Australia is an active participant in the COSPAS-SARSAT satellite-based distress beacon detection system. AMSA operates a satellite tracking station near Mingenew, Western Australia, and the Mission Control Centre (MCC) in Canberra, which processes distress beacon data for forwarding alerts to fifteen countries.</li> </ul> <p><u>Satellite communications</u></p> <p>Airservices Australia utilises GNSS information for en-route, terminal, approach and landing navigation, surveillance utilising Automatic Dependent Surveillance – Broadcast (ADS-B) and timing. This includes the Ground-Based Augmentation System (GBAS) in Melbourne and Sydney and the future deployment of the SouthPAN SBAS, on which Airservices, CASA and GA are working collaboratively. SBAS technology will improve the accuracy and integrity of PNT for the maritime sector and provide</p>

Organisation	Summary of activity
	increased procedural capability, enhance safety and regularity of flights. This will support aviation certified L1 service, with an expected in-service date of 2024/2025.
Geoscience Australia	<p>GA is implementing the National Positioning Infrastructure Capability (NPIC) and the Australian SBAS. In the 2018-19 Budget, GA received funding commitments for two satellite positioning measures, Better GPS for Australian Business and Better GPS for Regional Australia. Together, these projects will improve the accuracy, reliability and availability of positioning data from GPS and other satellite navigation systems.</p> <p>GA continues to collaborate with Land Information New Zealand (LINZ) on the development of a joint SBAS. This system has been officially named the Southern Positioning Augmentation Network (SouthPAN).</p> <p>SouthPAN will provide positioning capability to an accuracy of 10 cm across all of Australia, with ground-breaking applications in agriculture, mining and other industries. The SouthPAN project team progressed the procurement of the system components for SBAS, which will include a satellite and ground infrastructure, and data analysis capabilities.</p> <p>NPIC aims to drive productivity and innovation in industries, such as transport, agriculture, mining and construction, by providing more accurate GPS data. GA is rolling out the upgrade of its national network of ground stations as part of the NPIC. The network will comprise 200 ground stations across the Australian continent. NPIC also supports the operation and standardisation of up to 500 third-party GNSS reference stations located in key areas of Australia. The data streams from these stations will be openly available and be used to improve the performance and coverage of the capability</p> <p>GA operates the national SLR Network with stations at Mount Stromlo (ACT) and Yarragadee (WA) contributing to the ILRS. In 2021 the Yarragadee Station was affected by Tropical Cyclone Serroja. The Station was operational again soon after the event with onsite power generators. Communications were available within a week of the cyclone.</p> <p>In partnership with the University of Tasmania, GA also operates the national Very Long Baseline Interferometry (VBLI) array with stations at Hobart (TAS), Yarragadee (WA) and Katherine (NT) contributing to the International VLBI Service (IVS).</p>

## Earth Observation Services

*Earth observation (EO) has untapped potential to grow Australia's economy, for example, by improving agricultural monitoring, water management, and monitoring shipping routes. Through Geoscience Australia's Digital Earth Australia (DEA) initiative, Australia is world-leading in this field. Australia will continue to focus on and develop this priority area to grow Australia's broader economy.*

Earth observation delivers significant economic and social good benefits to Australia, in areas such as agriculture, water and environmental management, and disaster management. The *Australian Civil Space Strategy 2019-2028* identified this Priority Area as part of Phase 1 (2018-2019) and the Earth Observation Technology Roadmap is expected to be delivered by late 2021.

Table 8 – SCC Earth observation activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau's goals are to contribute to zero lives lost due to natural hazards, with \$2 billion in added social and economic value for Australians by 2022 in five identified priority sectors: Aviation and Land and Maritime Transportation; Agriculture, Energy and Resources; Water; National Security and Defence Industries. EO from space and space weather services significantly contribute to meeting these goals.



Organisation	Summary of activity
	<p>The Bureau’s weather, climate, ocean and water services are underpinned by Earth observation satellites. The Bureau’s forecast models assimilate real-time data from around 30 different satellites in Low Earth (LEO) and Geostationary (GEO) Orbits.</p> <p>The Bureau also generates many EOS-derived products, including Atmospheric Motion Vectors (AMVs), fog and low cloud, solar radiation, volcanic ash, sea surface temperatures and others.</p> <p>The Bureau has been working closely with the Australian Space Agency, GA, CSIRO and research partners on the development of the Earth Observations Roadmap.</p> <p>In support of the development of the Australian Space Agency's EO Roadmap, in April 2021 the Bureau commissioned the Australian National Concurrent Design Facility (ANCDF) to undertake a Pre Phase A study to consider the feasibility of Australian designed and built satellites to support weather forecasting. The Pre Phase A Study will be released in August 2021.</p>
CSIRO	<p>The CSIRO Centre for Earth Observation (CCEO) supports the following activities:</p> <ul style="list-style-type: none"> <li>• coordinating delivery of underpinning Earth observation science, including: a satellite data quality assurance and calibration and validation work program; and EO informatics expertise via the Earth Analytics Science and Innovation (EASI) Hub, a high-performance DataCube analytics platform which delivers petabyte-scale EO datasets in analysis ready format and utilities for sophisticated time-series analysis, web-services, model-data fusion and model-data assimilation, supporting science and applications projects for researchers and industry</li> <li>• support for inter-agency and international cooperation, providing the primary point of contact on EO matters for CSIRO</li> <li>• development of advanced satellite optical sensing instruments</li> <li>• linkages to EO industry and innovative applications development for next generation sensing systems, including oversight of the Defence Materials Technology Centre High Altitude Sensor Systems Program (for which CSIRO provides the Program Leader on secondment)</li> <li>• operations, data management and R&amp;D for the Australian capacity share of the UK-operated NovaSAR-1 satellite.</li> </ul> <p>CSIRO and Geoscience Australia represent Australia and the Australian Space Agency on key programmatic aspects of international coordination on Earth observation from space:</p> <ul style="list-style-type: none"> <li>• CSIRO and GA are establishing multiple new initiatives around furthering the OpenDataCube technology. Regionally, CSIRO is deploying the EASI DataCube technology in Singapore and partnering with Geoscience Australia to launch the platform as a basis for collaboration with Association of South East Asian Nations (ASEAN) organisations on climate smart applications</li> <li>• CSIRO serves as Australian principal on the Committee on Earth Observation Satellites (CEOS) and as a member of the Australian Government delegation to the Group on Earth Observations (GEO). Through the CSIRO Centre for Earth Observation, CSIRO:is serving as Co-Chair (together with GA) of the CEOS Strategic Implementation Team (SIT) from Oct 2019 for 2 years to strategically lead the space data providers and ensure CEOS delivers its Work Plan</li> <li>• is co-chairing the CEOS international team working on the Sustainable Development Goals looking at satellite data requirements to support specific indicators monitoring water quality, urbanisation, marine pollution and land degradation</li> </ul>

Organisation	Summary of activity
	<ul style="list-style-type: none"> <li>• chaired (to Nov 2020) the CEOS international working group on calibration and validation (WGCV) which conducts research and development to ensure long-term confidence in the accuracy and quality of EO data and products and provides a forum for the exchange of information about calibration and validation, including the coordination of cooperative activities</li> <li>• chaired (to Nov 2020) the CEOS international working group information systems and services (WGISS) which streamlines the effective delivery of EO data and provides a forum for the exchange of information about data analytics, including the coordination of cooperative OpenDataCube activities across agencies</li> <li>• is serving as the CEOS Representative on the GEO Executive Committee</li> <li>• was appointed by the UN Convention to Combat Desertification to revise and update the Good Practice Guidance document to include new tools and datasets, and define methods to link assessments of land degradation at global to local levels.</li> </ul> <p>CSIRO has been assisting the Group of Earth Observation (GEO) with the use of EO data for: UN Sustainable Development Goals; Future Data Architectures; the GEO Land Degradation Neutrality Initiative and the GEOGLAM (Rangelands and Agricultural Crop Monitoring) Flagship.</p> <p>CSIRO contributed technical and coordination expertise to the 2020 Bushfire Earth Observation Taskforce led by the Australian Space Agency, together with Geoscience Australia and the Bureau of Meteorology, the findings of which were published in December 2020.</p> <p>CSIRO has contributed technical and programmatic expertise to the development of the national Earth Observation from Space Roadmap jointly developed by the Australian Space Agency, CSIRO, Geoscience Australia, the Bureau of Meteorology and other organisations.</p> <p>In partnership with the SmartSat CRC, CSIRO undertook the user consultation phase ('Phase 0') of AquaWatch Australia as part of its emerging Missions portfolio. The goal of AquaWatch Australia is to establish a comprehensive ground-to-space national water quality monitoring system to safeguard our freshwater and coastal resources and grow Australia's high-tech space industry. The mission is being co-designed with collaborators from across industry, research and government.</p>
Department of Defence	<p><b>Space-based Geospatial Intelligence Collection.</b> The Defence Intelligence Group, within the Department of Defence, is responsible for delivering the Defence 799 series of projects. These currently provide enhanced access to commercial satellite imagery and will deliver the future space-based imagery capability to support Defence, national security and whole-of-government activities.</p> <p><b>Defence Project 799 Phase 1</b> – “Enhanced Commercial Access” is a project that provides Defence access to commercial satellite imagery to support strategic intelligence requirements and foundation mapping. During FY 20/21, Phase 1 reached Full Operational Capability, enabling the Australian Geospatial-Intelligence Organisation to directly task Earth observation satellites from a Defence operations centre and downlink imagery through antenna sites around Australia.</p> <p><b>Defence Project 799 Phase 2</b> - “Enhanced Satellite Intelligence, Surveillance and Reconnaissance Capability” will deliver future space-based imagery to meet the needs of Defence, the National Intelligence Community and whole-of-government.</p> <p>During FY 20/21, Phase 2 entered the Risk Mitigation and Requirements phase of Defence's capability lifecycle. Initial Operating Capability is planned for the later part of this decade, with follow-on investments to extend the capability beyond 2040.</p>

Organisation	Summary of activity
Department of Home Affairs	<p>The CIPMA maintains awareness of: disaster/hazard monitoring; weather monitoring and forecasting; national security and law enforcement surveillance; environmental and land use monitoring; remote Infrastructure monitoring</p> <p>During the 2020–21 High Risk Weather Season, Emergency Management Australia utilised satellites of the European Commission’s Copernicus Emergency Management Service to provide valuable geospatial products in support of the emergency response for the Western Australia bushfires (February 2021) and the New South Wales floods (April 2021).</p>
Department of Infrastructure, Transport, Regional Development and Communications	<p>DITRDC leads Australia’s engagement in key international radiocommunications policy-making fora discussing WRC-23, including agenda items dealing with space weather sensors used for global predictions and warnings, and frequency allocations and protection for Earth observation-satellite service.</p> <p>AMSA uses satellite-based Synthetic Aperture Radar data to monitor for illegal oil discharge from vessels within Australian waters and as evidence in marine pollution prosecution.</p>
Geoscience Australia	<p>GA continues to provide routine, reliable and robust intelligence about the Earth, its resources and how these have changed over the recent past. The Digital Earth Australia (DEA) program translates EOS data into free ready-to-use insights about Australia’s natural and built environment.</p> <p>GA, with the Department of Foreign Affairs and Trade, African Space Agencies and Amazon Web Services, is delivering Digital Earth Africa to provide 54 African countries with access to ready-to-use satellite data following a similar model to that pioneered with DEA.</p> <p>GA supports Earth Observation Australia (EOA). EOA plays a key role in bringing together government, business, research and other players in the Earth observation community.</p> <p>GA, the Bureau of Meteorology and CSIRO are jointly responsible for EOS capability in Australia. They are co-chairs of the Space Coordination Committee’s Earth Observation from Space Working Group (also known as AGEOSWG).</p> <p>Geoscience Australia has also supported the Australian Space Agency in developing the Earth Observation technology roadmap, and commissioned a series of reports to inform this process:</p> <ul style="list-style-type: none"> <li>• In March 2021, GA commissioned the University of New South Wales’ Australian National Concurrent Design Facility (ANCDF) to examine the feasibility of an Australian satellite program. The ANCDF study found that the Australian space sector had the technical and programmatic capability necessary to deliver an Australian sovereign satellite cross-calibration radiometer (SCR) mission in support of the NASA/USGS (United States Geological Survey) Landsat program.</li> <li>• In June 2021, FrontierSI, EOA, and the SmartSat CRC delivered the <i>AusCalVal: Establishing Australia as a global leader in delivering quality assured satellite Earth observation data</i> report. Commissioned by GA on behalf of the Agency, BoM, CSIRO and the Australian EO community, the <i>AusCalVal</i> report explores the emerging opportunity for Australia to become a global leader in the provision of satellite data quality assurance through investment in ground and space infrastructure.</li> </ul> <p>In support of this roadmapping process, GA also commissioned Deloitte Access Economics to undertake an economic analysis of the Australian Earth observation sector, and to examine the potential economic benefits of an Australian sovereign satellite program. The study found that in 2019-20, the Australian EO sector directly contributed \$283 million in value added to the Australian economy and employed 1,570 FTEs. In addition, the sector generated benefits for end users of EO data of more than \$2.5</p>

Organisation	Summary of activity
	<p>billion. The largest benefits are to agriculture, mining, construction, and severe weather management.</p> <p>Deloitte also found that Australia’s EO sector, and the benefits EO data generates for other industries, is exposed to a significant sovereign supply risk: <i>Australia does not own or operate any EO satellite systems</i>. Were a denial-of-service event to affect supplies of free and open EO data to Australia, the study estimated 81% of activity in the EO sector (equating to \$226 million in direct value) would cease to exist as we know it almost immediately. Furthermore, the Australian economy (GDP) would contract by \$1.9 billion due to the disruption in activity by end users of EO data.</p> <p>GA have developed a ground surface movement reconnaissance product derived from satellite radar EO data covering the entire state of NSW for the NSW Department of Planning, Industry and Environment. This is extending on GA’s 2019/20 delivery of subsidence observations in the Sydney Basin. The Interferometric Synthetic Aperture Radar (InSAR) technique used can generate millimetre accurate measurements with high spatial resolution and coverage to provide reconnaissance on surface movements and crustal changes.</p> <p>In June 2021, FrontierSI published its second report in a series which examines the potential application of EO data across key sectors. <i>Extracting the Benefits of Earth Observation</i> provides current and potential users of Earth Observation data the insights they need to maximise engagement with businesses in the Australian Mining sector as well as the Mining Equipment, Technology and Services (METS) sector.</p>

## Case study: Monitoring flow for more than 300,000 kilometres



Figure 12 – Using satellite data to monitor environmental water flow

In 2020, Digital Earth Australia supported the Murray-Darling Basin Authority (MDBA) and the New South Wales Natural Resources Access Regulator (NRAR) to conduct the largest, most systematic water monitoring effort in the history of the state.

Using open-source Landsat and Sentinel satellite data, as well as data from commercial service provider Planet, NRAR monitored an environmental flow of water as it travelled across an impressive 306,400 square kilometres of landscape, past more than 3,500 on-farm storages.

NRAR’s Chief Regulatory Officer, Grant Barnes, said that as a result of its partnerships with the MDBA and GA, NRAR now has eyes in the sky.

“We increased our capacity to monitor on-farm storage units by almost 500 percent, from 600 to 3,500 storage units,” he [said](#).

## Leapfrog Research and Development

Australia has a strong research base in space-related R&D, contributing 6.8 per cent of the world's publications in this sector between 2012 and 2016<sup>8</sup>. To transform our space sector and leapfrog into new areas consistent with broader economic and security interests, Australia can encourage and support research that inspires, identify areas to develop, and commercialise R&D that would grow and transform the space sector.

Areas of new opportunity include new rocket technologies, new high-tech materials, space medicine, synthetic biology, quantum communications, in-orbit servicing, and optical wireless communication technologies. The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 3 (2021-2028). To align with the M2M initiative, the development of the Space Medicine and Life Sciences Technology Roadmap has been progressed.

Table 9 – SCC Research and development activities

Organisation	Summary of activity
Australian Antarctic Division	<p>The Australian Antarctic Division (AAD) collaborates with NASA, the Translational Research Institute for Space Health (TRISH) and various universities on research in space medicine and life sciences utilising Antarctica as a space analogue.</p> <p>AAD is a partner in the Centre for Antarctic, Remote and Maritime Medicine (CARMM), which provides an academic pathway through the University of Tasmania in healthcare in remote and extreme environments. This includes a space medicine graduate certificate through to PhD Candidature, as well as delivery of University of Tasmania (UTAS) - Australasian Society of Aero-space Medicine (ASAM) Humans in Space Course and Units. CARMM partner, the Tasmanian Government has launched a new Hypobaric/Hyperbaric Chamber at the Royal Hobart Hospital.</p> <p>The Antarctic Division is also providing ongoing support for the development of the Australian Human Research Institute for Space and Extreme Environments (AHRISSE) with partners UTAS, CSIRO and the Tasmanian Government.</p> <p>The Australian Antarctic Science Strategic Plan (released April 2020) notes space and astronomy under its Human Presence and Activities theme. Updated processes for delivering projects under this plan will be announced by the AAD and the Australian Antarctic Science Council in the second quarter of 2021/22.</p>
Bureau of Meteorology	<p>Bureau scientists are actively involved in international science teams, including the Sentinel-3 Validation Team for Temperature (S3VT-T), GHRSSST Science Team, GOES-R Technical Advisory Committee, the GOES-R Independent Advisory Committee, the CloudSat Science Team, and the GPM Science Team. Membership of these teams enables early access to data for testing, and leveraging through collaboration on algorithm development.</p> <p>Ongoing work on climate science research projects to customers (such as the Northern Australia Climate Project, Antarctic Science Partnership and Forewarned is Forearmed).</p> <p>Ongoing work on strategic science research projects that improve Bureau services and increase our value and impact (such as Bush Fire and Natural Hazards CRC projects).</p> <p>Development of radar/satellite nowcasting applications.</p>
CSIRO	<p>As Australia's national science agency, CSIRO undertakes an extensive range of space research and development activities, in areas including:</p> <ul style="list-style-type: none"> <li>• small satellite technologies (including sensors, power systems and materials)</li> <li>• Earth observation data analytics</li> <li>• communications and signal processing</li> </ul>

<sup>8</sup> Office of the Chief Economist Australian Innovation System Report 2017

Organisation	Summary of activity
	<ul style="list-style-type: none"> <li>• robotics, remote operations and in situ resource utilisation</li> <li>• space life sciences</li> <li>• extremely sensitive receiver technologies</li> <li>• asteroid bistatic radar techniques.</li> </ul> <p><u>Space Technology Future Science Platform</u></p> <p>The Space Technology Future Science Platform (Space FSP) aims to build world-leading capability and drive cutting-edge research within CSIRO, generating new innovations that hold the potential to generate significant societal benefits and commercial opportunities and will help transform the Australian space sector.</p> <p>In 2020-21 the Space FSP supported projects across a wide range of new cutting-edge research activities in the following areas:</p> <ul style="list-style-type: none"> <li>• small satellite technologies, including hyperspectral imaging sensors, rollable and self-deployable solar arrays, high-power batteries for space applications, on-board data processing, and novel additive manufacturing of structural components</li> <li>• Earth observation data analytics and applications, including synthetic aperture radar science and multi-sensor DataCube implementation</li> <li>• communications and signal processing, including the translation of radio astronomy technologies to ground station technology for space communications systems, terahertz technologies for high-speed in-space communications, free space optical communications atmospheric research, and the use of pulsars as True Random Number Generators for security, navigation and timing applications</li> <li>• robotics, remote operations and in situ resource utilisation, including techniques for off-Earth resource modelling, technologies for resource exploration, characterisation and extraction, multi-resolution 3D scanning technologies, and lunar dust mitigating surface coatings</li> <li>• space life sciences, including development of a novel light-controlled closed experimental system suitable for experimenting on human cells cultured in microgravity, and technologies to recycle carbon dioxide, produce fresh food and prolong the life of packaged foods in space.</li> </ul> <p>In March 2021 innovative titanium/invar hybrid CubeSat components additively manufactured by CSIRO's Lab22 were successfully launched into space as part of the M2 satellite, in partnership with UNSW Canberra Space, DMTC and others.</p> <p><u>CSIRO Space 2.0 Workshops</u></p> <p>The Space 2.0 Workshops support opportunities for Australian space start-ups and SMEs to develop research and business collaborations with CSIRO, the wider research sector, aerospace primes, and space technology end-users. The 5th workshop, held in October 2020 in conjunction with the Australian Space Agency, specifically targeted opportunities in space for the manufacturing sector.</p>
Department of Defence	<p>The Defence Innovation, Science and Technology portfolio, led by Defence Science and Technology Group, comprises research programs that support Defence operations and current capability, and provide ongoing advice for the acquisition, sustainment and future-proofing of Defence capability.</p> <p>DSTG contributes to the development of Australia's space capabilities through coordinating and focusing Defence space innovation, science and technology efforts to Defence's highest strategic priorities; partnering with the national Science and Technology enterprise; and collaborating with international partners.</p>



Organisation	Summary of activity
	<p>Defence Science and Technology Group has three key space strategic research (future-proofing) activities:</p> <ul style="list-style-type: none"> <li>• The Resilient Multi-mission Space Science, Technology and Research (STaR) Shot project to focus future strategic research and proactively develop and demonstrate leap-ahead Defence space technologies and capabilities, including by undertaking exemplar small satellite missions. A Strategic Partner will soon be announced to help deliver these exemplar small satellite missions.</li> <li>• The Next Generation Technologies Fund Space Capabilities theme to focus the nation's capacity in the research, development and demonstration of innovative and resilient space technologies on Defence's highest priorities in space Science, Technology and Research.</li> <li>• Under the Space Strategic Research Initiative, DSTG, supported by Air Force, is developing the Buccaneer Main Mission CubeSat in partnership with Inovor Technologies who are developing the satellite bus. The Buccaneer Main Mission primary payload is an advanced digital high-frequency radio receiver to support calibration research for the Jindalee Operational Radar Network. It is scheduled for launch in 2022.</li> </ul> <p>Defence is a core member of the SmartSat CRC, with its contribution funded by the Next Generation Technologies Fund Space Capabilities theme. Defence is working with the SmartSat CRC to deliver high-risk, high-payoff collaborative research, increase industry capacity and capabilities, and provide technology outcomes that can be matured and demonstrated under the Resilient Multi-mission Space STaR Shot project. Defence and Defence Industry guidance to the program is achieved through the SmartSat Defence and National Security End User Advisory Board.</p> <p>In February 2021, Defence released a Request for Proposal for an Advanced Radio Frequency Payload Research Network. The focus of this academic and industry partnership is to develop an innovative payload that can be integrated with commodity small satellite bus technology for demonstration under the Resilient Multi-mission Space STaR Shot program. The mission concept is an affordable Synthetic Aperture Radar that would contribute to a broad area, all-weather, and day-night maritime surveillance capability. The evaluation of the responses is completed and the Research Network is being established.</p> <p><u>Defence Innovation Hub</u></p> <p>The Defence Innovation Hub (the Hub) funds the development of innovative technologies with the potential to enhance Defence capabilities and build Australia's defence industry sector.</p> <p>The Hub is contributing to the growth of the Australian space sector by investing in the development of space-related technologies in areas such as space domain awareness, satellite communications and data fusion.</p> <p>Since its launch in December 2016, the Hub has invested \$42 million in space related innovation projects. The Hub's investment in Australia's space industry has supported around 100 jobs across the country.</p>
Department of Home Affairs	<p>The Counter Foreign Interference Coordination Centre (CFICC) coordinates whole-of-government efforts to counter foreign interference in Australian society. The CFICC works closely with at risk sectors, including publicly funded research agencies such as the Australian Space Agency, to raise awareness of foreign interference risks and support resilience building to safeguard the continued development of open and transparent Australian research and collaboration.</p> <p>Home Affairs is also working across Government and with academic and research institutions to protect research from unwanted or malicious technology transfer.</p>

Organisation	Summary of activity
<p>Department of Industry, Innovation, Science Energy and Resources</p>	<p>The International and Astronomy Branch (IAB) facilitates the Australian astronomy community to conduct research and development by leading, coordinating and delivering on the Government’s investments in astronomy. Highlights include:</p> <ul style="list-style-type: none"> <li>• The world-leading scientific Square Kilometre Array (SKA) radio telescopes to be built and operated with other countries through the inter-governmental SKAO. A highlight in the 2020-21 financial year was the IAB, as Australia’s representative, and working with other countries, voting in June 2021 to commence global construction of the SKA telescopes. This decision allowed procurement activity to increase, including in Australia. Construction will commence at the Australian site once necessary agreements and other arrangements are in place.</li> <li>• Australia will host the low frequency SKA telescope (SKA-Low) at CSIRO’s Murchison Radio-astronomy Observatory (MRO) in WA. The Australian Government committed \$387 million in the 2021-22 Budget to support Australia’s participation in the SKA project. Part of this funding will contribute to Australia’s commitment to fund 14% of the SKA project’s 10 year construction and operation costs. Australia will receive a commensurate return on construction work for Australian businesses and share of telescope time for the Australian astronomy community.</li> <li>• Under the Australia-European Southern Observatory (ESO) Strategic Partnership, a multinational consortium led by the Australian National University and Macquarie University, partnering with the Istituto Nazionale di Astrofisica (INAF, Italy) and the Laboratoire d’Astrophysique de Marseille (LAM, France), entered into a contract with ESO on 1 June 2021. The contract is for building and operating a major new astronomical instrument, the MCAO (Multi-Conjugate Adaptive Optics) Assisted Visible Imager and Spectrograph (MAVIS), which will become part of ESO’s 8-metre Very Large Telescope (VLT). By correcting for effects of turbulence in the atmosphere, MAVIS will produce images sharper and deeper than the Hubble Space Telescope. The project is expected to return up to 194 nights of guaranteed observing time, using MAVIS, to the consortium partners.</li> </ul>
<p>Department of Infrastructure, Transport, Regional Development and Communications</p>	<p><b>DITRDC</b> leads Australia’s engagement in key international radiocommunications policy-making fora discussing WRC-23 agenda items, including item 1.13 dealing with frequency allocation to space research services, which expects to provide certainty for administrations and space agencies participating in satellite space programs.</p> <p><b>AMSA</b> is collaborating with a low earth orbit satellite provider to test reception of transmissions from 406 MHz distress beacons – a possible precursor to using such a capability for tracking and identification of search and rescue events, prior to launching a response.</p> <p><b>Airservices Australia</b> is working with the industry to launch a new collaboration to share information and technical expertise as part of the development of the space-based Communications and Surveillance service.</p>
<p>Department of Prime Minister and Cabinet</p>	<p>The PM&amp;C plays a policy and coordination role for critical technologies. This includes supporting the promotion and protection of Australia’s space technology development in the research sector. A key part of PM&amp;C’s support is a foresight capability to detect technological developments that may significantly impact Australia’s national security interests, economic prosperity and social cohesion. A proactive approach to mapping the innovation ecosystem in this area informs whole-of-government critical technologies priorities and thus optimise where targeted market intervention occurs.</p>
<p>Geoscience Australia</p>	<p>During the Hayabusa2 landing at Woomera (6 December 2020), GA collected observations from its network of GNSS receivers on the re-entry of the sample capsule through the Earth’s atmosphere. This information enabled calibration and validation of</p>

Organisation	Summary of activity
	<p>ionosphere models that are used for future real-time precise positioning applications, ultimately supporting improved accuracy for GNSS users.</p> <p>GA works closely with users and employees within the National Collaborative Research Infrastructure Strategy (NCRIS) facilities to ensure that EOS datasets are consistent across research and operational platforms.</p> <p>GA works closely with the research community and established networks, like the Terrestrial Ecosystem Research Network (TERN) NCRIS facility, to help identify areas where EOS datasets and applications will be of future interest to Australian Government users and the private sector.</p>

## Robotics and Automation

*Australia is a world leader in remote asset management in industries including mining, oil and gas, transport, agriculture, and fisheries. Australia can leverage its expertise in robotics technology and systems for remote operation and exploration in space. Such systems are becoming more accessible with the lowering cost to access space.*

Robotics and automation will play an increasing role in space activities in the coming decade. Australia is already a world leader in remote operations, providing a base of expertise that can be transferred to robotic operations in the space environment.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 3 (2021-2028). A Technology Roadmap highlighting opportunities in this sector for Australia is expected to be published by the end of 2021.

*Table 10 – SCC Robotics and automation activities*

Organisation	Summary of activity
CSIRO	<p>CSIRO contributed technical and coordination expertise to the development of the Agency's national robotics and automation roadmap.</p> <p>CSIRO undertook space research and development activities in numerous areas related to robotics, remote operations and in situ resource utilisation, including techniques for off-Earth resource modelling, technologies for resource exploration, characterisation and extraction, multi-resolution 3D scanning technologies, and lunar dust mitigating surface coatings.</p>

## Access to space

*There are emerging opportunities for Australia to leverage international space missions and commercial launch activities from Australian territory to support industry growth. Protecting national safety and meeting international and national obligations will be critical before domestic launch can occur.*

The global space sector is being transformed, opening up opportunities for companies of all sizes, universities and even schools to send payloads to orbit.

The Space (Launches and Returns) Act 2018, along with its associated rules and regulations, broadens the regulatory framework to include launches from aircraft in flight and high power rockets. Agency activities in relation to the regulation of space activities is reported under the Responsible pillar.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 3 (2021-2028).

*Table 11 – SCC Access to space activities*

Organisation	Summary of activity
Bureau of Meteorology	The Bureau of Meteorology will provide meteorological data critical to the safe launch of rockets from Indigenous launch platforms.
Department of Foreign Affairs and Trade	DFAT supports Australian negotiations with the United States to develop a bilateral Technology Safeguards Agreement to facilitate US involvement in space launch activities from Australia.
Department of Home Affairs	The ABF provides customs policy advice and procedural support for space-related materials. This support may include advice on Australia’s customs requirements for goods departing to or returning from space; the entry into Australia of supporting equipment, and general advice on Australia’s customs arrangements.
Department of Infrastructure, Transport, Regional Development and Communications	Airservices provides air space management services during launch and recovery operations.

# Responsible

*Promote a space sector culture that is globally respected, ensures national safety and security under an appropriate regulatory framework, and meets international obligations and norms.*

## Regulation associated with space activities

The Agency is responsible for regulating civil space and high power rocket activities under the *Space (Launches and Returns) Act 2018* (the Act) and its associated rules, the *Space (Launches and Returns) (General) Rules 2019*, *Space (Launches and Returns) (High Power Rocket) Rules 2019* and the *Space (Launches and Returns) (Insurance) Rules 2019*. The General Rules contain the application requirements for launch facility licences, Australian launch permits, overseas payload permits, return authorisations and authorisation certificates. The Insurance Rules set out the insurance/financial requirements, including the specified minimum amount of insurance. The High Power Rocket Rules define the characteristics of high power rockets and articulate the specific requirements for the permit.

The Agency also has responsibility for implementing Australia's obligations under the United Nations space treaties. This includes domestic implementation under the Act.

### Office of the Space Regulator

Following a re-organisation with the Australian Space Agency, the Office of the Space Regulator was established in September 2020 to oversee the implementation of regulations associated with Australian civil space activities. In May 2021, the Agency received an additional \$13.3 million in the 2021 Federal budget including funds to increase the capacity to deliver regulatory services.

In the 2020-2021 period the Agency received 3 launch facility licence applications and 3 Australian launch permit applications. Within the reporting period, the Minister for Industry, Science and Technology granted 9 overseas payload permits for the launch of satellites by Australian nationals overseas. These included satellites from EchoStar and Fleet, launched from the SpaceX Transporter-2 mission (1 July 2021) and satellites from Myriota, Fleet and UNSW Canberra, launched on Rocket Lab's *They Go Up So Fast* mission (23 March 2021).

March 2021 saw an important milestone for the space sector, with the Minister for Industry, Science and Technology granting Australia's first launch facility licence to Southern Launch for the Koonibba Test Range, in western South Australia. Prior to the granting of this licence, two high power rockets were launched from the Koonibba Range on 19 September 2020. Southern Launch used the Demonstration of Autonomous Rendezvous Technology (DART) launch vehicle from rocket manufacturer T-Minus Engineering, with payloads including from DEWC Systems. A launch facility licence for Southern Launch's Whalers Way Orbital Launch Complex (also in South Australia) is expected to be approved in July 2021. Equatorial Launch Australia's launch facility licence and Australian launch permit applications for the Arnhem Space Centre commercial space port in the Northern Territory progressed to assessment.

In August 2020, the Minister for Industry, Science and Technology granted an Authorisation of return of overseas launched space object (under the Space Activities Act 1998) to JAXA for the return of the Hayabusa2 asteroid sample capsule. The Agency worked closely with JAXA regarding Hayabusa2, with return and retrieval from Woomera, South Australia conducted 6 December 2020 (refer to case study).

In November 2019, the Australian Government agreed to introduce partial cost recovery arrangements for assessment of applications made under the Act. These fees were deferred due to impacts of the COVID-19 pandemic and did not apply during 2020-2021. Consultation with industry on partial cost recovery was undertaken and closed on 12 April 2021. After the consideration of industry input, the Australian Government announced on 1 July that the introduction of partial cost recovery will be delayed for a further 12 months until 1 July 2022. This deferral will encourage launch activity and continued investment and growth in the broader space sector.

The Agency continued to receive and progress a number of applications for complex activities under the *Space (Launches and Returns) Act 2018*. Complex applications can take up to six months from the time all relevant information is provided.

*Table 12 – SCC Space regulation activities*

Organisation	Summary of activity
Attorney-General's Department	AGD provides advice to Government on international space law issues.
Australian Communications and Media Authority	<p>The ACMA manages access to the radiofrequency spectrum through the development and maintenance of a regulatory framework for satellite services in Australia, and through licensing of space services.</p> <p>The ACMA maintains a register of Statutory Infrastructure Providers (SIPs) and their service areas. The Minister for Communications, Cyber Safety and the Arts can also make standards, rules and benchmarks, with which SIPs must comply</p>
Bureau of Meteorology	The Bureau attends the World Radiocommunication Conferences and the APT Conference Preparatory Group meetings. It is also a member of the World Meteorological Organisation Steering Group on Radio Frequency Coordination (SG-RFC).
CSIRO	<p>CSIRO is a key member of ACMA's space spectrum advisory group for space tracking and assists spectrum discussions to ensure consistency with the NASA Space Tracking Treaty.</p> <p>CSIRO also chairs two Working Parties (3M and 7D) of the International Telecommunications Union Radiocommunication Sector (ITU-R).</p>
Department of Defence	<p>DSTG provides support to the Defence Spectrum Office with orbital spectrum licensing strategies including securing new radio frequency bands for increased communication bandwidth and greater diversity.</p> <p>The Defence Aviation Safety Authority is investigating requirements for Defence space regulation and accident investigation.</p>
Department of Foreign Affairs and Trade	<p>DFAT forms part of the Australian delegations to UNCOPUOS and its subcommittees.</p> <p>It is also working with the Agency to implement the UNCOPUOS Guidelines for the Long-term Sustainability of Outer Space Activities.</p>
Department of Infrastructure, Transport, Regional Development and Communications	<p><u>International Radiocommunications</u></p> <p>DITRDC is involved in the ITU processes, particularly the World Radiocommunication Conference (WRC), that make amendments to the Radio Regulations, the international treaty agreement which governs the global use of radio frequency spectrum and satellite orbits.</p> <p><u>Universal Service Guarantee</u></p> <p>DITRDC is responsible for the Government's Universal Service Guarantee (USG) to provide access to broadband as well as voice services. The USG is underpinned by the statutory infrastructure provider (SIP) laws, which took effect on 1 July 2020.</p> <p><u>Airspace Regulation</u></p>



Organisation	Summary of activity
	CASA's Office of Airspace Regulation (OAR) administers and regulates Australian-administered airspace and is responsible for determining the architecture, classification and level of services for all Australian airspace. This includes mitigation through airspace solutions to protect all airspace users from launches and recoveries of rockets and space vehicles.
Geoscience Australia	GA is appointed as a legal metrology authority under the <i>National Measurement Act (1960)</i> to provide legal chains of traceability for satellite-derived positions of GNSS tracking stations.

## High Power Rocket Rules 2019

The *Space (Launches and Returns) Act 2018* includes the regulation of the launch of high power rockets in Australia. The *Space (Launches and Returns) (High Power Rocket) Rules 2019* (the High Power Rocket Rules) define the characteristics of high power rockets and articulate the specific requirements for the permit.

During July and August 2020, the Civil Aviation Safety Authority (CASA) undertook public consultation on proposed amendments to the Civil Aviation Safety Regulations 1998 to align with the *Space (Launches and Returns) (High Power Rocket) Rules 2019*. CASA and the Agency have worked together to avoid overlapping regulatory frameworks. The Agency will continue to work with CASA to support Australian high power rocket activities.

Following amendments to civil aviation legislation in late 2020, CASA is responsible for regulating air risks of rocket activities including through grant of area approvals, and ground risks of rocket activities other than for high power rockets and space objects. The Australian Space Agency collaborates with CASA to coordinate regulatory requirements of both agencies to ensure that all high-altitude aviation activities are conducted with the safety of aviation navigation as the highest consideration.

## Reform of the Radiocommunications Act 1992

On 17 June 2021, reforms to Australia's spectrum management framework commenced, as set out in the *Radiocommunications Legislation Amendment (Reform and Modernisation) Act 2020*. These reforms meet the current and future demands of spectrum users by streamlining the current arrangements, removing regulatory barriers to innovation, and promoting the efficient use of spectrum.

Bills were introduced into the Parliament following a public consultation process that commenced in 2019-20. This consultation process included consideration of input from the space industry.

DITRDC will continue to engage with the space industry to understand the effectiveness of the reforms and identify further areas for improving spectrum management.

# Inspire

*Partner in a vision to build an Australian space sector that inspires industry, researchers, government and the Australian community to grow the next generation of the space workforce.*

Inspire is a stand-alone pillar in the *Australian Civil Space Strategy 2019-2028*, recognising the important role space can play in inspiring our community and encouraging our students to engage in Science, Technology, Engineering, and Mathematics (STEM) studies. With a target of growing the workforce by 20,000 additional jobs by 2030, it is important that Australia builds a strong workforce pipeline to support the future needs of the space industry.

## Australian Space Discovery Centre

The centrepiece of the Agency's Inspire pillar is the Australian Space Discovery Centre (ASDC), which aims to inspire the next generation of the space workforce with stories of innovation, curiosity and technology. The ASDC offers a place for the community to explore the latest innovations in space technologies, enabling visitors to learn about Australia's role in expanding national and international space activities.

Co-located with the Australian Space Agency Headquarters at the Lot Fourteen innovation precinct in Adelaide, the ASDC incorporates the SIF-funded Mission Control Centre, the only publicly viewable facility of its type in Australia. Operated by Saber Astronautics, the MCC provides a real-time opportunity for the general public and school groups to interact with space professionals working on the cutting edge of the space industry. The MCC can be viewed through a theatrette where live space events, guest speakers and other opportunities to engage with space experts can be presented.



*Figure 13 – The ASDC in operation. (L-R.) Viewing the MCC from the theatrette; visitors in the Careers Hub.*

The ASDC includes a Careers Hub, showcasing job opportunities in the space industry and highlighting the diverse range of people and careers in the Australian space sector. The Careers Hub provides information on STEM education options for young people to explore pathways for a future in space.

Visitors to the ASDC can also experience an interactive, hands-on space exhibition that provides an exciting and dynamic environment for young people to learn about Australian involvement in space activities, innovation and the nation's growing space sector.

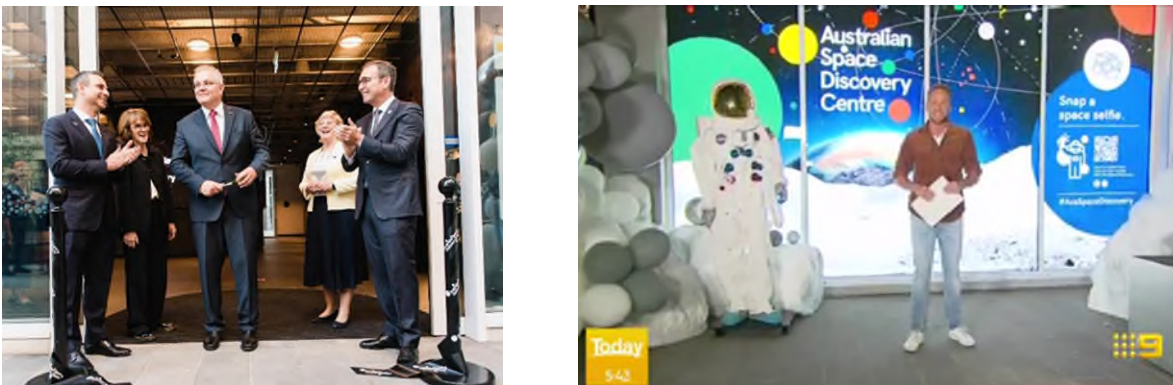


*Figure 14 – Views of the interactive space exhibition*

The Agency partnered with Questacon, the National Science and Technology Centre, to develop the concept design and educational content of the ASDC. While targeting high school and undergraduate students, the ASDC is designed to be accessible and inspirational to the general public and visitors of all ages.

The \$6.0 million Australian Space Discovery centre was funded through the Adelaide City Deal, managed by DITRDC, in conjunction with the development of the Agency Headquarters and the MCC. Construction of the ASDC and MCC commenced with a sod-turning media event in September 2020, and was completed in late January 2021. Questacon installed the interactive space exhibition throughout February and March, and key staff leads were recruited.

On 31 March 2021, the Prime Minister officially unveiled the Australian Space Discovery Centre in a ceremony that attracted considerable media attention.



*Figure 15 – Official opening of the Australian Space Discovery Centre. (L-R.) Prime Minister Morrison cuts the ribbon, declaring the ASDC open; Live weather broadcast from the ASDC on the Today show.*

COVID-19 social distancing and venue capacity requirements in South Australia made it necessary for the Agency to adopt a different mode of operation for the ASDC from the original concept, which would have allowed casual walk-in access to the facility, enabling visitors to browse the Centre’s offerings at leisure. With assistance from Questacon, the Agency developed and implemented a revised operating model for the ASDC, including plans to support detailed risk management and COVID-19 management practices.

Prior to the public opening of the ASDC, there was extensive stakeholder engagement with a number of trial sessions including business, industry and educational visitors allowing training for the Space Communicators, the Centre’s guides.

The ASDC opened to the public on 5 May 2021. There is currently no cost for admission to the Centre and there has been an overwhelming demand for tickets. By 30 June over 12,000 tickets were booked, and the



ASDC had welcomed almost 5,000 visitors. Visitors are required to pre-book for 75-minute sessions with strictly limited numbers.

A dedicated website for the [ASDC](#), including events, local activities, career information, and space industry profiles was developed and launched, enabling the much of the ASDC's content to be available nationally. Session bookings are also made through this website.

Advance bookings for schools opened in June and from Term 3 in 2021, the ASDC will start to roll out a school program. This offering will initially target secondary school groups and leverage the ASDC's STEM content along with the Careers Hub and accessible study pathway information.

On 4 May, supported by remarks from the Head of the Agency, Questacon launched a sibling exhibition to the Australian Space Discovery Centre, named *Australia in Space*. The two exhibitions are very similar, but have different target audiences and some different exhibits. After a season at Questacon in Canberra, this exhibition will be toured around Australia, leveraging the inspirational value of the ASDC.

## ASDC Brand and Promotion

In early 2021, the Minister for Industry, Science and Technology unveiled the official Australian Space Discovery Centre brand. A sub-brand of the Agency, the ASDC brand links to the parent theme, colours and constellations. Teasers commenced for the Australian Space Discovery Centre, with videos and brand messages released.

A high profile campaign to develop the awareness of the ASDC was undertaken from the Centre opening on 31 March 2021, continuing until the end of July. This included videos, brand messages, and bus and tram advertising throughout Adelaide. A full tram wrap that went live on 20 June, running for 4 weeks. The tram covered a large portion of metropolitan Adelaide, frequently travelling within the CBD in high traffic areas and increasing awareness of the Centre and the Australian Space Agency. An analysis of media coverage 1 April to 30 June found 822 mentions, with a potential audience reach of 11.3 million. The reach associated with the ASDC was significant, due to television and printed media promotion associated with the Prime Minister.

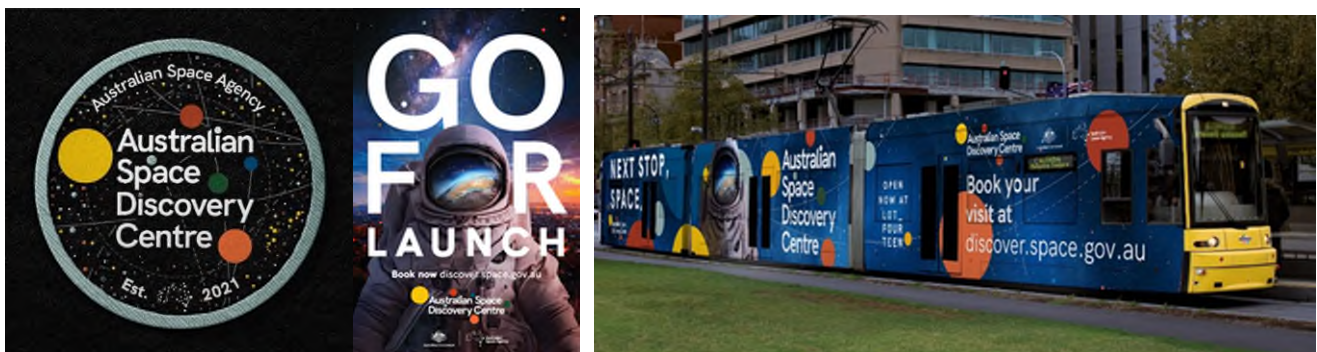


Figure 16 – ASDC brand and promotion. (L-R.) ASDC brand; Promotional image used in bus advertising; tram wrap promoting the ASDC.

## Events at the Australian Space Discovery Centre

### National Simultaneous Storytime

The Australian Space Agency, together with the Office of the Chief Scientist, were key sponsors for National Simultaneous Storytime (NSS) 2021, which took place on 19 May. The NSS is held annually by the Australian Library and Information Association. Every year a picture book, written and illustrated by an Australian author and illustrator, is read simultaneously in libraries, schools, pre-schools, childcare centres, family homes, bookshops and many other places around the country, to promote children's literacy. In 2021, the featured

NSS book was *Give Me Some Space*, by Phillip Bunting. It tells the story of a young girl's dream to go to space. The book promotes space careers, curiosity about STEM, and pathways for women and girls in space. It was also read from the International Space Station by astronaut Dr Shannon Walker in partnership with NASA's Storytime from Space program.

In 2021, over 1.98 million readers at 33,418 locations took part in NSS. Agency staff and Advisory Board members read at local schools, to highly positive feedback. The Agency also hosted author Phillip Bunting at the Australian Space Discovery Centre for the flagship Scholastic publishers NSS event, with a local Adelaide primary school in attendance. This event, which included Dr Walker's reading from the ISS, was made available nationally via Facebook Live.



Figure 17 – Agency involvement in National Simultaneous Storytime. (L-R.) Head, Enrico Palermo, and Advisory Board member Steven Freeland reading *Give Me Some Space* at local schools.

### Other ASDC Events

- In the two months from its opening to 30 June 2021, the Australian Space Discovery Centre also participated in local STEM-related events: “Space for All”, as part of the *DreamBIG Children’s Festival* in collaboration with the Children’s University of Australasia and Africa, May 22-23.
- Public space history talk as part of *South Australia’s History Festival*, in collaboration with the History Trust of South Australia, 15 May.
- Student visits to ASDC as part of the *BiG Day In* secondary school careers conference at the University of Adelaide, in collaboration with the Australian Computer Society’s ACS Foundation, 17 June.

## Agency Events and Outreach

### Purra the Space Kangaroo

In November 2020, NASA Astronaut Dr Shannon Walker carried a toy kangaroo, named Purra, to the International Space Station on board the NASA/SpaceX Crew-1 mission, on behalf of the Agency. Bringing toys to space has been a tradition for over 60 years, and the kangaroo is a symbol of Australia and our enduring partnership with NASA.

Purra takes his name from a sky story told by the Boorong People of Victoria, in which Purra the red kangaroo is pursued across the sky by the hunters Wanjel and Yuree. This star grouping is one of the Indigenous constellations depicted on the Australian Space Agency logo.

While displaying Purra during a video message from the ISS, Dr Walker spoke Australian Indigenous language in space, sharing the story of the Agency brand and the Indigenous constellation featuring Purra and the two

hunters. Purra spent six months in orbit on the ISS, returning to Earth in May 2021. A toy based on Purra is available in the ASDC shop and has proved a popular item with visitors.



Figure 18 – NASA Astronaut Dr Shannon Walker delivering a video message to Australia with Purra on board the ISS

## National Science Week and World Space Week 2020

Due to the COVID-19 pandemic, events for National Science Week, World Space Week and other outreach activities in 2020 were largely held virtually, with live online events and activities and social media campaigns.

- During **National Science Week**, 15-23 August 2020, the Agency, in collaboration with DISER, ran a digital campaign to generate awareness of amazing work undertaken in the Australian science community.
- The Agency's digital content included promoting various virtual space events, highlighting several of the International Space Investment grant recipients, and showcasing the fascinating work being achieved across the Australian space sector. Successful social media results were achieved, with content for the week generating more than 29,000 Facebook and 130,000 Twitter impressions, in addition to more than 2,000 Facebook and 3,300 Twitter engagements.
- To highlight the role of space in National Science Week, the Agency created its first STEM learning resources for primary and secondary students. It also supported the #Satellite Selfie event, which overflowed the ACT and Northern Territory, and a number of other STEM events.
- During **World Space Week**, the Agency ran a social media campaign across Facebook and Twitter using the theme 'Satellites Improve Life'. The Agency developed a series of short animated videos demonstrating how integral satellite technology is to our everyday lives using tangible examples.
- The campaign was positively received among the community, with strong channel engagement. The content generated more than 42,700 Facebook and 145,600 Twitter impressions, in addition to more than 1,700 Facebook and 2,670 Twitter engagements.

## Seeds in Space – What'll Happen to the Wattle

The Seeds in Space program (also known as Asian Herbs in Space) is run by JAXA as part of the Asian Beneficial Collaboration for Kibo Utilization (Kibo-ABC). As the Australian representative for Kibo-ABC, the Agency is working with a local organisation, the One Giant Leap Australia Foundation, to undertake the Seeds in Space program in Australia.

As part of this program, One Giant Leap Australia arranged to send five packets of golden wattle seeds from the Australian Tree Seed Centre at CSIRO to the ISS onboard the SpaceX CRS-21 mission in December 2020 for the *What'll Happen to the Wattle?* project. The seeds will return to Earth in July 2021 and be distributed to 300 national locations for planting. 130 of those locations have an Indigenous population of more than five percent, including some participating groups that are 100% Indigenous. 170 locations have a language background other than English of more than 10%.



Over 270 schools across Australia will participate in comparing the growth of the ‘space-seedlings’ with seedlings that have remained on Earth. Each school will receive a package containing three sets of seeds: a test set, for the teachers to trial the program and check they have everything in place, an Earth set and the space set. Each set contains six of wattle seeds, with the Earth set and space set having come from the same seed batch.

*What’ll Happen to the Wattle* is the largest space science education project undertaken in Australia to date and will run over multiple years. The program provides a wide range of educational opportunities for students in areas including botany, ecology, agriculture and space ethics.

## Additional Events and Outreach

In addition to the events and activities already noted in this report, a selection of further events and outreach activities that the Agency supported in 2020-21 are outlined below. These are representative of the broad range of inspiration and education activities undertaken by the Agency and not an exhaustive list. As a result of COVID-19, many events across the year were either cancelled or conducted in a virtual setting.

Table 13 – Agency events 2020-2021

Event	Date	Comment
Marryatville Primary School STEM Day	14 August 2020	Agency staff visited Marryatville Primary School, South Australia for their Day of STEM. They shared their career experiences, and the range of careers in the space industry with students in Years 5 and 6.
<i>Out of the World</i> Exhibition, National Archives of Australia	29 Sept 2020 – 14 March 2021	The <i>Out of this World: Australia in the space age</i> exhibit by the National Archives of Australia explores the impact of the space race on Australian popular culture, as well as Australia’s role in space activities. It features a video narrative by Agency Head, Dr Megan Clark covering Australia’s space history and the future of Australian space activities. The exhibition is touring nationally from 2021-2024.
YMCA Space Squad	January 2021	The Agency has been presenting at the YMCA Space Squad, in the ACT, regularly since April 2019. In January 2021, Agency staff presented to approximately 60 students at the YMCA Space Squad programs – residential space programs for students in grade 2-6 (Junior), 6-9 (Youth) and 10-12 (Senior).
Australian Mathematical Sciences Institute Summer School	11 Jan – 5 February 2021	The Agency presented at the careers day during the Australian Mathematical Sciences Institute (AMSI) Summer School, discussing future mathematics and data careers in the space sector.
Australian Youth Aerospace Association Astra Program	December 2020 – March 2021	The Agency presented at the Australian Youth Aerospace Association (AYAA) Astra program, which brings together university students from interdisciplinary backgrounds to discuss and address scenarios facing the global space sector. For 2020-2021 the topic was “Creating a Blueprint for Launch in Australia” and the Agency provided background information on regulatory processes and permit applications to give context on scenarios around launch in the Southern Hemisphere.
Defence Service Attaché Advisory Group	21 May 2021	The Australian Space Discovery Centre hosted a visit by over 30 international Defence Service Attachés
AI4Space Workshop	1 June 2021	The Agency supported the AI4Space workshop, highlighting the space capabilities that draw from and/or overlap significantly with vision and learning research.

Event	Date	Comment
Australasia Satellite Forum	22 - 23 June 2021	The Agency attended this major satellite conference with Head, Enrico Palermo, providing a keynote address and other Agency staff participating.

## Sponsorships

In its third year of operation, the Agency commenced sponsorships of organisations and activities that align with the Agency’s Inspire pillar, particularly in the support of STEM education. This sponsorship may be through funding or in-kind support.

Table 14 – Agency sponsorships

Organisation/Activity	Comment
Australian Technology Competition	The Australian Technology Competition (ATC) is a national competition sponsored by the Commonwealth and Victorian Governments, Accelerating Commercialisation, the industry growth centres, the Agency and industry partners. The Agency is supporting the competition’s Space Award. This competition provides a platform to promote Australian emerging technology, small to medium enterprises, and scale up across key industry sectors of the economy including the Australian Government’s six growth sectors. The 19 national finalists for the 2020 competition were announced in October 2020. The 2021 competition opened on 28 April 2021.
Maxar Spatial Challenge	The Maxar Spatial Challenge is jointly organized by Maxar, Arlula and Consilium Technology. It is aimed at promoting the value of space derived intelligence in addressing key challenges identified by stakeholders within Australia; identifying and supporting key innovators within Australia that can leverage space intelligence and address key challenges; and developing sustainable solutions that can be scaled and applied on a regional or national level. The Challenge was announced on 30 July 2020, with the winners announced on 9 December 2020. Maxar Spatial Challenge sponsors include the Agency and SmartSat CRC.
Gravity Challenge	GRAVITY Challenge is a global technology innovation program for corporates, entrepreneurs and universities to design and build solutions to real industry, social and environmental problems using space data and capability. The second Gravity Challenge was run between August 2020 and February 2021. Gravity Challenge 3 commenced in March 2021 and will run until December 2021, with a UK-AUS SpaceBridge Focus. Gravity Challenge sponsors include the Agency, SmartSat CRC and Geoscience Australia.
Aviation/Aerospace Australia Space Mission 2040	The Women in A/AA careers campaign and SPACE MISSION 2040 Year 2 competition took place over Term 2 and Term 3 2020. The competition included a combination of online learning resources and a spacecraft-building component for kids on the return to the classroom. This activity is part of the ‘No other career can take you higher’ campaign by Women in Aviation/Aerospace Australia. It features a space careers video; careers information brochure designed to answer questions that children, parents, teachers or careers advisors may have about the aerospace industry.
2020 National Awareness Raising Women in STEM initiative (NARI)	The Agency partnered with the Office of the Women in STEM Ambassador by sponsoring the character “Mirra the Moon to Mars Mission Director” in the Future You program that highlights working in STEM. This initiative is designed to raise awareness of the exciting career possibilities and real-world

Organisation/Activity	Comment
	applications of STEM skills. Future You showcases 12 diverse and relatable STEM-based characters, including Mirra. Targeting children aged 8 to 12 and their parents and carers, Future You launched on 30 October 2020
International Women's Day 2021	To mark International Women's Day 2021, Engineers Australia arranged a visit to Australia by the first Black female NASA astronaut, Dr. Mae Jemison. Dr. Mae Jemison has been a driver of change and innovation throughout her diverse career. The Agency supported Dr. Jemison's appearance and an associated space industry panel <i>Australia's Place in Space</i> , featuring female Australian space leaders.
NASA Global Learning and Observations to Benefit the Environment (GLOBE) program	CSIRO manages the delivery of NASA's Global Learning and Observations to Benefit the Environment (GLOBE) program in Australia in partnership with the Australian Space Agency. GLOBE is a worldwide hands-on, science and education program focusing on the environment, active in over 120 countries.
Australian Youth Aerospace Association	In March 2021, the Agency entered into a national partnership with the Australian Youth Aerospace Association (AYAA), a not-for-profit organisation managed by student volunteers and young professionals. AYAA's objective is to promoting education, awareness and involvement in the aerospace industry to young Australians.
South Australian Space School	The Agency provided sponsorship to support the Mission to Mars program at the South Australian Space School, based at Hamilton Secondary College, Adelaide. Mission to Mars is a full-day, scenario-based program in which students work in teams and use problem-solving skills to successfully complete a geological survey on a simulated Mars surface.
Andy Thomas Space Foundation	In 2021, the Andy Thomas Space Foundation launched its Space Education Fund to provide scholarships to support space education opportunities in Australia. The Agency provided sponsorship to support these scholarships.

## Agency Inspiration Plan

*Inspire* is one of the four pillars of the Australian Space Agency and encompasses both the workforce needs and wider community engagement that the Agency requires to achieve its goal of tripling the size of the Australian civil space sector by 2030. As part of their twelve-month placement within the Department, DISER Graduate Development Program interns undertook a three month major project in the latter part of 2020, to develop an Inspiration Plan for the Agency to support increasing STEM studies and career take-up and inspire the nation.

The report was delivered in November 2020 and presented a series of ambitious recommendations for the development of the Agency's *Inspire* pillar, based upon three key opportunities identified by the research that can be utilised to inspire and engage Australians and build a skilled, globally recognised, diverse workforce. These recommendations are outlined below.

*Table 15 – Recommendations for the Agency Inspiration Plan*<sup>9</sup>

<sup>9</sup> G = Government, E = Education, I = Industry

Recommendations	Enablers <sup>1</sup>
<b>1. Cohesion</b>	
1.1 Establish an intergovernmental forum on space to discuss and coordinate education, external partnership and workforce strategies.	G
1.2 Facilitate a coordinated national strategy for supporting space outreach and education.	G, E
1.3 Build <i>Inspire</i> into agreements between the Agency and education and industry partners.	G, E, I
<b>2. Awareness</b>	
2.1 Increase public awareness and community engagement with the broader space sector.	G, E, I
2.2 Improve the visibility of space industry jobs across all professions.	G, I
2.3 Establish and support targeted outreach and education programs for underrepresented and disadvantaged groups, including Aboriginal and/or Torres Strait Islander peoples, women, people from culturally and linguistically diverse backgrounds and people with a disability.	G, E
<b>3. Pathways</b>	
3.1 Support space-related education and skills development across primary, secondary, vocational and tertiary education.	G, E, I
3.2 Facilitate clear career pathways into a range of space sector professions.	E, I
3.3 Establish and support educational resources and targeted recruitment programs for underrepresented and disadvantaged groups, including indigenous Australians, women, people from culturally and linguistically diverse backgrounds and people with a disability.	G, E, I

The Agency is currently considering the implementation of the report's recommendations, consistent with available resources.

## Media Reach

The Agency monitors the potential cumulative audience reach, through media, of the Agency's activities. For the period 1 July 2020 – 30 June 2021, an analysis of coverage found a total of 3,424 mentions. This reached a cumulative potential of 46,591,272 across the reporting period. The high profile of the Hayabusa 2 sample capsule return and the opening of the ASDC boosted the media impressions for December 2020 and April 2021.

# Results Snapshot

## SOCIAL MEDIA 3-8 Dec

**4.23 million**

social media impressions

**386,715**

social media engagements

**2,160**

new social media followers

## TRADITIONAL MEDIA 30 Nov-31 Dec

**14.54 million**

potential audience reach

**921**

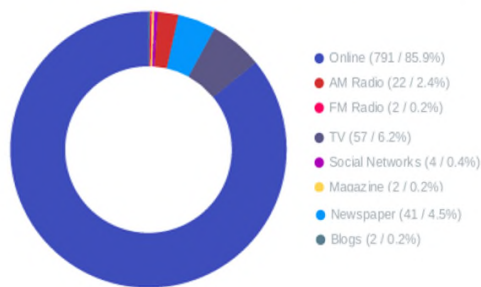
media mentions

**A\$12.33 million**

estimated Advertising Sales Rate (ASR)

## Media Analysis

### Total coverage by Media Type (921 items)



### Popular keywords



- Coverage during the week of 1-8 December was successfully generated for all major media outlets across TV, Radio, Online and Print.
- Australian media highlights included 4 live crosses for ABC News Breakfast plus a live segment for the Nine's Today Show with Minister Karen Andrews MP.
- A pre-record of JAXA's Prof Masaki Fujimoto and Dr Megan Clark enabled a post landing interview, which was not possible to do live due to location restrictions at the RAAF base.
- Other highlights includes coverage in news.com.au, The Australian and all state-wide NewsCorp publications.

Figure 19 – Media analysis for the Hayabusa 2 sample capsule return



# Results Snapshot

## SOCIAL MEDIA

**254,839**

social media impressions

**9,192**

social media engagements

**1,014**

new social media followers

## TRADITIONAL MEDIA

**1.62 million**

potential audience reach

**25**

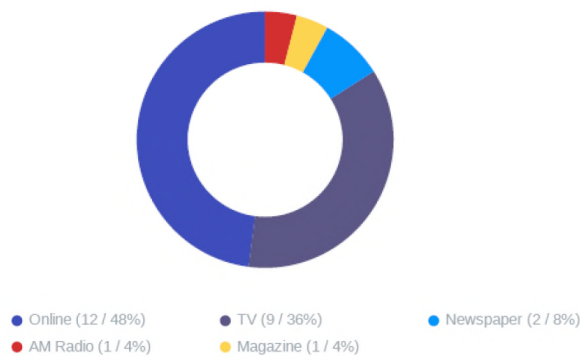
media mentions

**A\$637.9k**

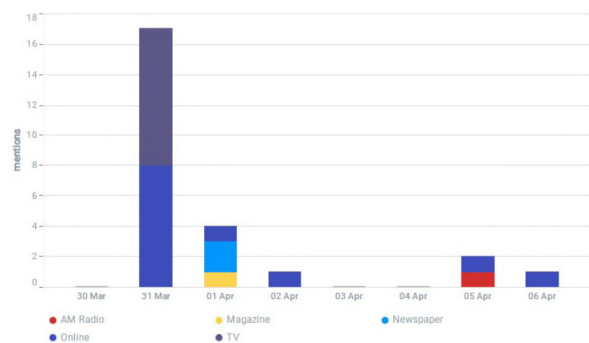
estimated Advertising Sales Rate (ASR)

## Media Analysis

Total coverage by Media Type (25 items)



Coverage overtime by media type



Coverage was successfully generated with media outlets across TV, Radio, Online and Print.

Australian media highlights included 7 live weather crosses with Channel 9's Today Show, Ten News and Seven News coverage, plus mention in broader Sunday Mail article.

Figure 20 – Media analysis for the opening of the Australian Space Discovery Centre

On 27 August 2020 the Supply Chain Capability grants were opened by the Minister for Industry, Science and Technology. The Agency activated a strategic communications plan to amplify the Minister's announcement which included: an Agency news article, social media campaign, special edition Agency newsletter, a M2M 'glossy' and sharing a communications pack with over 15 industry communication stakeholders and over 10 industry media outlets. The Agency also hosted its first ever public webinar to provide information about the program and grant application process, which was attended by over 270 people. The total estimated reach of the strategic communications plan and related media and communications activities was over 550,000.



## New Social Media Account and Videos

To complete its suite of social media accounts, the Agency launched its Instagram channel on 24 March 2021, joining its existing LinkedIn, Twitter, Facebook and YouTube accounts. The Instagram launch formed part of the promotion of the official opening of the ASDC, highlighting its careers focus with a series of posts under the theme “I’m Part of Space.”



Figure 21 – The first post on the Agency’s Instagram account, launched 24 March 2021

A dedicated website for the ASDC, including events, local activities, career information, and space industry profiles was developed and launched, enabling the much of the ASDC’s content to be available nationally. Session bookings are also made through this website. Across 2020-2021 the Agency produced a number of videos which were released on its YouTube channel and other social media. These included: a series *Launching Australian Industry into Space*, released in February 2021, which highlighted Australian companies working in the space sector to illustrate the range of industries that can participate in space-related activities; a teaser and promotional videos for the Australian Space Discovery Centre opening; a video from the ISS featuring Purra the space kangaroo and astronaut Dr. Shannon Walker; and presentations to support the Agency’s Moon to Mars Initiative and its associated grant programs.

To reach the broadest possible national audience with information about Agency programs, a number of webinars were held across the year highlighting Moon to Mars grant programs, the release of the *Communication Technologies and Services Roadmap*, and other Agency initiatives.

Two small social media campaigns were undertaken in April and May 2021 to highlight the 60th anniversary of human spaceflight. The April campaign highlighted the anniversary of the first human spaceflight by Yuri Gagarin on 12 April 1961. The second marked the anniversary of the first US crewed spaceflight on 5 May 1961. The opening of the Australian Space Discovery Centre coincided with the latter date.

A summary of other inspirational and workforce-building activities by SCC members is outlined below.

Table 16 – SCC inspirational and workforce-building activities

Organisation	Summary of activity
Australian Antarctic Division	Australian Antarctic Division Polar Medicine Unit, through <a href="#">CARMM</a> and its partner, the University of Tasmania, has developed the academic pathway Healthcare in Remote and extreme Environments. This includes units and research opportunities in space medicine as an extreme environment. This builds on the AAP’s longstanding collaboration with NASA since 1993 utilising Antarctica as a space analogue. This work inspires Australians with the human aspects of space and helps to develop the future workforce for supporting missions to Moon and Mars.

Organisation	Summary of activity
	<p>The development of the Australian Human Research Institute for Space and Extreme Environments will coordinate, inspire and promote space medicine and life sciences in Australia and globally.</p>
<p>Bureau of Meteorology</p>	<p>The Bureau is a member of CSIRO's STEM Professionals in Schools program.</p> <p>Bureau alumni on the Superstars of STEM program include Dr Sue Barrell and Dr Linden Ashcroft.</p> <p>The Bureau of Meteorology Space Weather Services regularly hosts university level interns to work on space science projects. It has also contributed space weather content to the development of RMIT's Bachelor of Space Science</p> <p>The Bureau worked with Questacon to provide input into the design of a 'space weather' wall feature now installed at the Australian Space Discovery Centre at Lot 14 in Adelaide. The space weather wall shows a visual representation of the sun's activity and its impacts on key industries and daily life, and also features profiles of two of the Bureau's prominent space weather scientists.</p> <p>The Bureau was a sponsor at the 11th Australian Space Forum, in Adelaide in March 2021. The Forum is a key event on the 2021 space agenda and presented a great opportunity increase awareness of the Bureau's space related activities.</p> <p>As part of the Forum the Bureau also participated in the 'Space Passport' program which was an opportunity to provide secondary and university students the opportunity to learn about space careers direct from companies involved with the Australian Space Sector. Over 130 students, parents and teachers participated.</p>
<p>CSIRO</p>	<p>One of CSIRO's core functions is "to train, and to assist in the training of, research workers in the field of science and to cooperate with tertiary education institutions in relation to education in that field". CSIRO partners with universities and other research institutions through co location, co-publication and collaborative research to boost innovation and ensure the best available research is used to solve the greatest challenges and deliver outcomes for Australia and the world.</p> <p>CSIRO delivers extensive public outreach and education activities related to space, which connect with, inspire and educate audiences spanning industry, professionals in the field, the general public and students. In 2020-21 this included:</p> <ul style="list-style-type: none"> <li>• The visitors' centres at the Parkes and Compact Array radio telescopes and at CDSCC together attracted over 145,000 public visitors to their sites, inspiring students and families to understand astronomy and space sciences.</li> <li>• Delivery of NASA's Global Learning and Observations to Benefit the Environment (GLOBE) program in partnership with the Australian Space Agency.</li> <li>• Regular space-related stories published in CSIRO's 'Double Helix' magazine for children aged 8-14 years.</li> <li>• CSIRO supported the 10th and 11th Australian Space Forums, including the Student Passport sessions.</li> <li>• CSIRO's PULSE@Parkes educational program, designed to give school students the opportunity to observe with the Parkes radio telescope, ran observing sessions remotely due to COVID-19. More than 180 students from 20 schools and over 25 teachers in five States and Territories took part.</li> <li>• CSIRO and ANU are collaborating on the development of a space education project for high school students. The focus will be on the range of careers in the space industry.</li> </ul>
<p>Department of Defence</p>	<p>Defence continues to educate its growing space workforce through development of military focused space courses and sponsoring individual postgraduate space</p>

Organisation	Summary of activity
	<p>education through the Australian Defence Force partnership with the University of New South Wales Canberra.</p> <p>Via this partnership, the M2 satellite was launched from New Zealand on 23 March 2021. M2 is the culmination of the Collaborative Project Agreement with the University of New South Wales Canberra to design, build and operate small satellites on behalf of Defence. The agreement enhances space education at the Australian Defence Force Academy, including two dedicated Masters Programs and various undergraduate courses. The M2 mission will test formation flying, inter-satellite laser communications, and innovative space domain awareness, maritime surveillance and satellite control technologies.</p> <p>Defence sponsored the 11th Australian Space Forum held in Adelaide in March 2021. Through DSTG, Defence is supporting the COSPAR-K activity in August 2021, which is a free STEM event focused on space that is running in partnership with the NSW Department of Education's STEM Industry School Partnerships Program.</p> <p>Defence was committed to non-emergency recovery operations during Operation Bushfire Assist and enabled remote connectivity via deployable satellite communication terminals operated by communications experts.</p>
<p>Department of Industry, Innovation, Science, Energy and Resources</p>	<p>The ASKAO operates both Twitter and Instagram accounts to keep the public informed about Australia's involvement in the SKA project. Typical content includes SKA project updates and news of achievements by SKA precursor telescopes, particularly the Murchison Widefield Array and Australian SKA Pathfinder. Friday trivia posts sharing SKA facts and experiences have driven engagement. Since February 2021, follower counts have grown by 21% - from 278 to 471 on Instagram, and from 1852 to 2096 on Twitter.</p> <p>The IAB maintains a broadcast, podcast and Twitter media presence through the outreach activities of its Astronomer-at-Large, Professor Fred Watson. The IAB also publishes a biannual Astronomy Newsletter, with online circulation throughout the Australian astronomy sector.</p> <p>Through the activities of its Astronomer-at-Large, the IAB has an advocacy and education role in maintaining public and scientific access to the night sky by reducing light pollution. This is carried out through membership of the Siding Spring Observatory (SSO) Dark Sky Committee, and membership of two Standards Australia committees governing lighting standards AS4282 and AS1158.</p>
<p>Geoscience Australia</p>	<p>In March and June 2021, GA's Digital Earth Australia program, together with Ernst &amp; Young, Microsoft, the Country Fire Authority and NASA delivered the <a href="#">2021 Better Working World Data Science Challenge</a>. The goal of the event was to enable firefighters to make more timely and informed decisions to help save lives, property and biodiversity from the effects of wildfires.</p> <p>The challenge brought together 8500 students from over 115 countries to develop an automated fire-edge detection and prediction model using satellite data and software developed by Digital Earth Australia.</p>
<p>Department of Home Affairs</p>	<p>Australia's skilled migration program is designed to meet Australia's economic and labour market needs, including the growth of Australia's space industry. The Australian Government supports this objective through a range of temporary and permanent skilled visa programs.</p> <p>Australia's permanent Migration Program focusses on visa categories that will help Australia's economy rebound from COVID 19, with priority given to visa cohorts that drive economic growth, job creation and investment into Australia.</p>

# Appendix

## Australian Government Departmental Functions

### Attorney General's Department (AGD)

The AGD delivers programs and policies to maintain and improve Australia's law and justice framework. AGD's Office of International Law provides legal advice to Government on international law. This includes advice on legal issues relating to space, to ensure Australia's engagement in the space domain is consistent with Australia's international obligations.

#### *Key space-related activities*

AGD's Office of International Law provides legal advice to Government on key international space law treaties. [AGD](#) is a member of the SCC and the Inter-Departmental Working Group on Space Law.

### Australian Antarctic Division (AAD)

The AAD is part of the Department of Agriculture, Water and the Environment (DAWE). The AAD leads, coordinates and delivers the Australian Antarctic Program, overseeing Antarctic, Sub-Antarctic and Southern Ocean science and technology. The Australian Antarctic Program includes space analogue research for space medicine and life sciences. AAD, in association with various agencies, including AMSA, provides Antarctic and Southern Ocean search and rescue capabilities.

#### *Key space-related activities*

The AAD collaborates with NASA, other institutions universities on research in space medicine and life sciences utilising Antarctica as a space analogue.

The [AAD](#) is a member of the SCC, the Agency's Space Medicine and Life Sciences Technical Advisory Group and the AHRISSE Working Group

### Australian Space Agency

The Agency is a non-statutory, whole-of-government entity located within the DISER as a separately branded function. The Agency is the front door for Australia's international engagement on civil space and operates as the national priority setting mechanism for the civil space sector.

#### *Key space-related activities*

The Agency is responsible for: providing national policy and strategic advice on the civil space sector; coordinating Australia's domestic civil space sector activities; supporting the growth of Australia's space industry and the use of space across the broader economy; leading international civil space engagement; administering space activities legislation and delivering on our international obligations; and inspiring the Australian community and the next generation of space entrepreneurs.

The [Agency](#) is the Chair of the SCC and a member of the Space Cross-Sector Interest Group. The Agency participates as an observer in the Interagency Operations Advisory Group Space Operations Sustainability (IOAG SOS) Working Group, developing a report providing recommendations related to sustainable space operations.

### Australian Communications and Media Authority (ACMA)

The ACMA is a statutory authority responsible for the regulation of radio communications services, including the radiocommunications licensing of space-based communications systems in Australia and International Telecommunications Union (ITU) satellite filing coordination.

#### *Key space-related activities*

The ACMA manages access to the radiofrequency spectrum through the development and maintenance of a regulatory framework for satellite services in Australia, including licensing. It also represents Australia's space spectrum management interests internationally, including the filing and coordination of Australian satellite systems with the ITU.

The [ACMA](#) is a member of the SCC and various working groups.

### **Australian Trade and Investment Commission (Austrade)**

The Austrade contributes to Australia's economic prosperity by helping Australian businesses, education institutions, tourism operators, governments and citizens as they develop international markets and promote international education, win productive foreign direct investment, strengthen Australia's tourism industry and seek consular and passport services.

#### *Key space-related activities*

Austrade and the Australian Space Agency collaborate under a joint MOU. Through this, Austrade agrees to use its services and global network to support the whole of government goal of attracting investment, tripling the size of the space sector and adding 10,000-20,000 new space jobs. Austrade's Sector Centre of Excellence for Defence, Advanced Manufacturing and Space Team manage Austrade's space initiatives and engagement with national and international clients and stakeholders.

[Austrade](#) is a member of the SCC.

### **Bureau of Meteorology**

The Bureau of Meteorology is Australia's national weather, climate, water and space weather agency. The Bureau relies on high quality, real time space-based and in-situ observations to deliver forecasts, warnings, analyses and advice covering Australia's atmosphere, water, ocean, and space environments. The Bureau actively supports Australia in providing expertise and services that inform customers as to the harsh realities of both the natural environment and the near-earth space environment. Space information used by the Bureau enables the successful delivery of vital information to meet Australia's needs.

#### *Key space-related activities*

The Bureau plans, builds and operates satellite reception infrastructure and maintains significant technical, engineering and science capability to support this infrastructure. The Bureau delivers satellite-derived products and services to the Australian community and supports leading-edge forecasting and climate research. The Bureau provides space weather services primarily for defence and communications activities and is a recognised global leader in this field. The Bureau is also responsible for sustaining the intergovernmental relationships, including with the World Meteorological Organization (WMO), essential to the global exchange of data.

The [Bureau](#) is a member of the SCC and Co-chair of the Australian Government Earth Observations from Space Working Group (AGEOSWG). It is a member (and current Chair) of the Australian National Ground Segment Technical Team (ANGSTT) and the AquaWatch Steering Committee and Science Team. The Bureau is also a member of the Australian Academy of Sciences National Committee for Space and Radio Science, which is currently developing the next 10-year strategy for space science and exploration.

### **Commonwealth Scientific and Industrial Research Organisation (CSIRO)**

CSIRO is Australia's national science agency, an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act 1949* which designates functions to: conduct scientific research to benefit Australian industry and the community, and to contribute to the achievement of national objectives; encourage and facilitate the application of the results of scientific research; manage and make available national facilities for scientific research; contribute to scientific collaboration between Australia and other countries; and contribute to training the next generation of Australian researchers.

Under the *Science and Industry Research Act 1949*, CSIRO is granted powers to undertake a broad range of activities consistent with performing the above functions. These include: arranging for scientific research to

be undertaken on behalf of the organisation; forming partnerships, joint ventures and spin-off companies; and deriving income from intellectual property through licensing and royalty arrangements.

More than 300 staff across the organisation are involved in space-related activities. CSIRO has developed extensive capability in space-related areas that include spacecraft tracking and communications, Earth observation, advanced space technologies, and radio astronomy.

#### *Key space-related activities*

CSIRO carries out space-related activities in the following areas:

- Spacecraft tracking and communications, including: operation of the Canberra Deep Space Communication Complex for NASA and 'Follow the Sun' operation of the NASA Deep Space Network; management of key treaty-level agreements with NASA; and management of ESA's New Norcia tracking station
- Operation of facilities including the Parkes radio telescope and the Australia Telescope Compact Array for both radio astronomy and space-related activities, including lunar communications and space object tracking
- Earth observation from space, including: joint responsibility for national EO capabilities with the Bureau of Meteorology and GA; development of advanced EO processing methods, applications and services; partnership in and Australian science access to the UK-operated NovaSAR-1 satellite; EO satellite data calibration/validation; fostering collaborative international scientific relationships, and providing national representation on international organisations such as CEOS and GEO.
- Development of new space technologies and capabilities, including through the CSIRO Space Research Program and the CSIRO Space Technology Future Science Platform
- Space education and outreach activities, and supporting industry innovation and growth through the Space 2.0 Workshops and industry partnerships with start-ups, SMEs and primes.

[CSIRO](#) is a member of the SCC.

Further information on CSIRO's space capabilities can be found through this [link](#).

Further information on the [CSIRO Centre for Earth Observation](#) can be found through its website.

Further information on the [Space Technology Future Science Platform](#) can be found through its website.

### **Department of Defence (Defence)**

The mission of the Australian Defence Force is to defend Australia and its national interests. Space capabilities are becoming increasingly critical for Australian Defence operations as a modern, networked military. The Department of Defence uses both military and civil space-based systems for a range of applications, including global positioning, navigating and timing; space domain awareness; satellite communications; intelligence, surveillance and reconnaissance; mapping; and weather forecasting. Defence requires assured access to these space-based capabilities that are an indispensable component of Australian and coalition military power.

#### *Key space-related activities*

Defence space-related activities include: contributing to space domain awareness; engaging with international partners on the military use of space; managing radiofrequency spectrum access to secure radiofrequency spectrum resources for Defence satellite networks; space-based imagery collection; space R&D programs.

[Defence](#) is a member of the SCC, the PNT Working Group, the Space Law Working Group, the Earth Observation Working Group, the National Security Space Interdepartmental Committee and the Critical Infrastructure-Systems of National Significance (CI-SONS) Space Working Group. Defence is represented on the Agency's Technical Advisory Group for Communications and Earth Observation and the SmartSat CRC Defence and National Security End User Advisory Board.



## Department of Foreign Affairs and Trade (DFAT)

DFAT provides foreign, trade and development policy advice to the Government. It works with foreign governments, the private sector, NGOs, academia and other Australian Government agencies to ensure that Australia's pursuit of its global, regional and bilateral interests are advanced and protected.

### *Key space-related Responsibilities*

DFAT's key space responsibilities lie in space security issues (with Defence), UN engagement on space issues including through the General Assembly, the Conference on Disarmament and the Committee on the Peaceful Uses of Outer Space (COPUOS) (with the Australian Space Agency), peaceful uses of space and development matters, multilateral and bilateral space-related agreements and commitments, space issues that affect bilateral and regional relationships, developmental applications of space-based capabilities and civil space matters to the extent that they affect the above. DFAT also provides international law advice, including on the five outer space treaties and other conventions and agreements

[DFAT](#) is a member of the SCC and participates in the Space Law Inter-Departmental Working Group. DFAT co-chairs with Defence the National Security Space Inter-Departmental Committee.

## Department of Home Affairs (Home Affairs)

The Department of Home Affairs (Home Affairs) and the Australian Border Force (ABF) have a set of diverse responsibilities that contribute to making Australia more secure, prosperous and united. These include: counter-terrorism; counter-espionage; combatting child exploitation; critical infrastructure security, transport security; federal law enforcement, criminal justice and policing for a safer Australia; cyber security; border security; immigration and citizenship; managing and responding to national emergencies; humanitarian issues; social cohesion and customs and trade related functions.

### *Key space-related activities*

A range of Home Affairs responsibilities have touch-points with space issues, including emergency management, trade, migration, biosecurity, aviation and maritime security, critical infrastructure, border operations, Australia's skilled migration program and Global Business and Talent Attraction Taskforce

Home Affairs is responsible for managing risks to Australia's critical infrastructure arising from catastrophic space weather events, as well as risks to Australia's national security arising from foreign investment and cybersecurity vulnerabilities in Australia's civil space infrastructure. Home Affairs is also responsible for the preparation and management of the Australian Plan for Space Re-Entry Debris as part of the Australian Government's Disaster Response Plan.

Through the Global Business and Talent Attraction Taskforce, Home Affairs is actively supporting the growth of the Australian space sector through the identification and facilitation of high-value businesses and extraordinary individuals across a range of future-focused industries including space technologies and advanced manufacturing.

The ABF provides import and export policy and procedures for space-related materials. The ABF also supports the Agency through the provision of border and traveller related information to enable the seamless movements of people, goods and equipment across the Australian border.

[Home Affairs](#) is a member of the SCC. Its [Critical Infrastructure Centre](#) is a member of the Space Cross Sector Interest Group and the PNT Working Group. The Department is additionally a member of the Whole of Government Interdepartmental Committee on ISRO Gaganyaan Mission.

## Department of Finance (Finance)

The Department of Finance is a central agency of the Australian Government and plays an important role in assisting government across a wide range of policy areas to ensure its outcomes are met.

Finance supports the Government's ongoing priorities through the Budget process and fosters leading practice through the public sector resource management, governance and accountability frameworks. Finance

plays a lead role in advising the Government on many of its strategic priorities and providing advice to the Government on optimal arrangements for the management and ownership of public assets.

[Finance](#) has observer status on the SCC.

## **Department of Industry, Science, Energy and Resources (DISER)**

The department's vision is to enable growth and productivity for globally competitive industries by supporting innovation, science and commercialisation; growing business investment and improving business capability; streamlining regulations; and building a high performance organisation. [DISER](#) provides policy advice on broader linkages between space and other industry sectors, such as defence and advanced manufacturing.

### *Key space-related activities*

The Australian Space Agency is a non-statutory, whole-of-government entity located within DISER as a separately branded function. The Secretary of DISER is the relevant Accountable Authority.

DISER's International and Astronomy Branch (IAB) leads, coordinates and delivers on the Australian Government investments in radio and optical astronomy. In radio astronomy, the Australian Square Kilometre Array (SKA) Office ([ASKAO](#)) oversees Australia's involvement in the SKA project. In [optical astronomy](#), the IAB manages the Australia-European Southern Observatory (ESO) Strategic Partnership and relationships with Australia's optical astronomy stakeholders.

The department has an ex-officio position on the Agency's Advisory Board and is a member of the SCC. In connection with the SKA project, DISER also maintains national committees to engage with Australian stakeholders: the Australian SKA Coordination Committee, the Australian SKA Science Advisory Committee, and the Australasian SKA Industry Cluster. DISER also appoints and convenes quarterly meetings of the Australia-ESO Coordinating Group.

## **Department of Infrastructure, Transport, Regional Development and Communications (DITRDC)**

DITRDC provides policy oversight of radiocommunications services and spectrum management (including satellite communication) in Australia. This includes supporting the relevant Minister make policy and regulatory decisions to facilitate major spectrum allocations, and progressing reforms to the legislative framework for spectrum management. DITRDC also leads Australia's engagement in international forums on use of radiofrequency spectrum and satellite orbits, including the World Radiocommunication Conference (WRC).

DITRDC is also responsible for the design and implementation of the Australian Government's infrastructure, transport and regional development policies and programs. It works to: support economic growth through transport; make travel safer; increase transport access; keep transport secure; support regional development and local communities and provide good governance in the territories.

DITRDC administers the \$2 million Alternative Voice Services trials program (or AVST), which aims to identify new ways to deliver voice services, including by new providers, to assess their effectiveness, and raise awareness of alternative solutions to provide better services and functionality. The trial services typically involve new applications of technologies like wireless and satellite.

### *Key space-related activities*

DITRDC is responsible for the development of the Universal Service Guarantee (USG), which provides for access to baseline broadband and voice services nationally, including use of space-based systems in rural and remote areas.

DITRDC's interests in civil space include the application of satellite-enabled services for road, rail, maritime and aviation sectors. These activities are carried out by DITRDC and its transport portfolio agencies: the Australian Maritime Safety Authority; the Civil Aviation Safety Authority, and Airservices Australia.

[DITRDC](#) is a member of the SCC, the National Space Security (NSS) Interdepartmental Committee (IDC); and the working group on the regulation of satellite base stations.

DITRDC leads Australia's multi-stakeholder Preparatory Group for WRCs and WRC agenda item coordination groups. These groups provide advice directly to DITRDC to inform Australia's preliminary views and positions on WRC agenda items.

DITRDC and AMSA, Airservices and CASA are members of the Position, Navigation and Timing Working Group (PNT-WG) chaired by Geoscience Australia.

DITRDC participates as a member of the SCC. AMSA is a member of the Space Cross-Sectoral Interest Group (Space CSIG);

Further information on communication services can be found at this [website](#).

### **Australian Maritime Safety Authority (AMSA)**

AMSA is Australia's national maritime safety regulator. AMSA promotes the safety of shipping and protection of Australia's marine environment. AMSA provides the infrastructure for safety of navigation in Australian waters and uses satellite technology for land, aviation and maritime search and rescue, pollution surveillance, oil spill and disaster response, ship and navigation safety and ad-hoc imagery.

### **Civil Aviation Safety Authority (CASA)**

CASA is Australia's aviation safety regulator, with responsibility for the safety regulation of civil air operations in Australian territory, the operation of Australian aircraft within and outside Australian territory and Australian-administered airspace.

CASA's Office of Airspace Regulation (OAR) administers and regulates Australian-administered airspace and is responsible for determining the architecture, classification and level of services for all Australian airspace. This includes mitigation through airspace solutions to protect all airspace users from launches and recoveries of rockets and space vehicles.

Following amendments to civil aviation legislation in late 2020, [CASA](#) is responsible for regulating air risks of rocket activities including through grant of area approvals, and ground risks of rocket activities other than for high power rockets and space objects. The Australian Space Agency collaborates with CASA to coordinate regulatory requirements of both agencies to ensure that all high-altitude aviation activities are conducted with the safety of aviation navigation as the highest consideration.

### **Airservices Australia (Airservices)**

Airservices provides air navigation and radio telecommunication services, including air traffic management for civil aviation, from the surface to the limit of atmospheric flight.

[Airservices](#) Australia is a member of the Position Navigation and Timing Working Group (PNT-WG).

### **Department of the Prime Minister and Cabinet (PM&C)**

The PM&C provides high quality advice and support to the Prime Minister, the Cabinet, Portfolio Ministers and Assistant Ministers to achieve a coordinated and innovative approach to the development and implementation of Government policies. It coordinates and develops policy across the Government in economic, domestic and international issues, and public service stewardship.

[PM&C](#) has observer status on the SCC.

### **Geoscience Australia**

GA is the Australian Government's national geoscience organisation, applying geoscience to Australia's most important challenges. It is the Australian Government's technical adviser on all aspects of geoscience, and custodian of the geographical and geological data and knowledge of the nation. The GA work program supports the work of other Australian Government agencies, state and territory governments, researchers, international partners, and industry.

### *Key space-related activities*

GA supports civil space activities through leadership and planning, operational service delivery, ongoing maintenance of infrastructure and data, strategic partnerships, and knowledge-transfer. These activities create value for stakeholders by supporting capability development and critical decision-making across the agency's six strategic priorities: building Australia's resource wealth; ensuring Australia's community safety; securing Australia's water resources; managing Australia's marine jurisdictions; providing fundamental geographic information, and maintaining geoscience knowledge and capability

GA is the lead agency for PNT and non-meteorological operational use of EOS in Australia. GA provides geoscience infrastructure, knowledge and expertise that assures access to space capability, supports innovation, science skills and development, strengthens domestic and international coordination, and protects economic well-being.

GA is jointly responsible for Australia's EOS capabilities with the Bureau and CSIRO and is developing Digital Earth Australia. As the lead agency for PNT, it is also developing the SBAS and the NPIC.

[GA](#) is a member of the SCC and co-chairs the Australian National Ground Station Technical Team (ANGSTT). Through this team agencies and state governments coordinate the development and use of Earth observation satellite ground stations. GA supports Earth Observation Australia, which plays a key role in bringing together government, business, research and other players in the Earth observation community. It co-chairs the SCC's EOS Working Group (AGEOSWG) with CSIRO and the Bureau. GA also chairs the PNT Working Group (PNT-WG), which advises the SCC on the current and future of civilian PNT activities in Australia, and is a member of the Space Cross Sectoral Interest Group.

### **Treasury**

As a central policy agency, the Treasury is expected to anticipate and analyse policy issues with a whole-of-economy perspective, understand government and stakeholder circumstances, and respond rapidly to changing events and directions.

Treasury provides sound economic analysis and authoritative policy advice on issues such as: the economy, budget, taxation, financial sector, foreign investment, structural policy, superannuation, small business, housing affordability and international economic policy. It also works with state and territory governments on key policy areas, as well as managing federal financial relations.

The [Treasury](#) has observer status on the SCC.

# References

## List of Figures

Figure 1 – Summary of the Australian Civil Space Strategy	8
Figure 2 – Inspiring the Australian community. Staff at the Australian Space Discovery Centre on public opening day, 5 May 2021	9
Figure 3 – The Agency Advisory Board	12
Figure 4 – Australian Space Agency Accomplishments 2018-21	14
Figure 5 – Virtual signing of the UK Space Bridge Framework Agreement 23 February 2021	24
Figure 6 – (top) Recovery of the Hayabusa 2 sample return capsule after landing in the Woomera Prohibited Area and (below) NASA’s SCIFLI team and Australian Space Agency staff at Adelaide Airport	26
Figure 7 – Map of the distribution of SIF projects around Australia	39
Figure 8 – Entry to the Pawsey Supercomputing Research Centre at Technology Park, Kensington WA	40
Figure 9 - Virtual MOU signings between the Australian Space Agency and (L-R.) the Northern Territory and Queensland	47
Figure 10 - Australian Space Agency booth at the 11 <sup>th</sup> Australian Space Forum, 31 March 2021	49
Figure 11 – Phase 1 CHORUS satellite terminal combining radio and optical frequency capabilities	59
Figure 12 – Using satellite data to monitor environmental water flow	66
Figure 14 – The ASDC in operation. (L-R.) Viewing the MCC from the theatre; visitors in the Careers Hub.	76
Figure 15 – Views of the interactive space exhibition	77
Figure 16 – Official opening of the Australian Space Discovery Centre. (L-R.) Prime Minister Morrison cuts the ribbon, declaring the ASDC open; Live weather broadcast from the ASDC on the Today show.	77
Figure 17 – ASDC brand and promotion. (L-R.) ASDC brand; Promotional image used in bus advertising; tram wrap promoting the ASDC.	78
Figure 18 – Agency involvement in National Simultaneous Storytime. (L-R.) Head, Enrico Palermo, and Advisory Board member Steven Freeland reading Give Me Some Space at local schools.	79
Figure 19 – NASA Astronaut Dr Shannon Walker delivering a video message to Australia with Purra on board the ISS	80
Figure 20 – Media analysis for the Hayabusa 2 sample capsule return	85
Figure 21 – Media analysis for the opening of the Australian Space Discovery Centre	86
Figure 22 – The first post on the Agency’s Instagram account, launched 24 March 2021	87

## List of Tables

Table 1 – Australian space sector performance – Snapshot of the key indicators	20
Table 2 – SCC international engagement activities	27
Table 3 – Summary of Demonstrator Feasibility Grant Allocations	42
Table 4 – SCC National security activities	51
Table 5 – SCC Communications technologies and services activities	53
Table 6 – SCC Space situational awareness and debris monitoring activities	59
Table 7 – SCC Position, navigation and timing activities	61
Table 8 – SCC Earth observation activities	62
Table 9 – SCC Research and development activities	67
Table 10 – SCC Robotics and automation activities	71
Table 11 – SCC Access to space activities	71
Table 12 – SCC Space regulation activities	74
Table 13 – Agency events 2020-2021	81
Table 14 – Agency sponsorships	82
Table 15 – Recommendations for the Agency Inspiration Plan	83
Table 16 – SCC inspirational and workforce-building activities	87

## List of acronyms

<b>AAD</b>	Australian Antarctic Division	<b>ASI</b>	Agenzia Spaziale Italiana (Italian Space Agency)
<b>AAP</b>	Australian Antarctic Program	<b>ASKAO</b>	Australian Square Kilometre Array Office
<b>ABC</b>	Australian Broadcasting Corporation	<b>ASKAP</b>	Australian Square Kilometre Array Pathfinder
<b>ABF</b>	Australian Border Force	<b>ASWAS</b>	Australian Space Weather Alert System
<b>ACMA</b>	Australian Communications and Media Authority	<b>ATC</b>	Australian Technology Competition
<b>ACT</b>	Australian Capital Territory	<b>ATNF</b>	Australia Telescope National Facility
<b>ADF</b>	Australian Defence Force	<b>AUD</b>	Australian dollar
<b>ADS-B</b>	Automatic Dependent Surveillance – Broadcast	<b>AUSMIN</b>	Australia-United States Ministerial Consultations
<b>AGEOSWG</b>	Australian Government Earth Observation from Space Working Group	<b>AusTender</b>	Australian Government online tendering system
<b>AGD</b>	Attorney-General’s Department	<b>Austrade</b>	Australian Trade and Investment Commission
<b>The Agency</b>	Australian Space Agency	<b>AVST</b>	Alternative Voice Services Trials
<b>AHRISEE</b>	Australian Human Research Institute for Space and Extreme Environments	<b>AYAA</b>	Australian Youth Aerospace Association
<b>AHT-SDG</b>	Ad Hoc Team on Sustainable Development Goals	<b>BeiDou</b>	Global navigation system developed by China
<b>AI</b>	Artificial Intelligence	<b>BDS</b>	BeiDou Navigation Satellite System
<b>Airservices</b>	Airservices Australia	<b>BSS</b>	Business Satellite Service
<b>AMSA</b>	Australian Maritime Safety Authority	<b>The Bureau</b>	Bureau of Meteorology
<b>AMVs</b>	Atmospheric Motion Vectors	<b>C5</b>	Critical Five (Australia, Canada, New Zealand, UK, US)
<b>ANGSTT</b>	Australian National Ground Segment Technical Team	<b>CaVal</b>	Calibration and Validation
<b>ANCDF</b>	Australian National Concurrent Design Facility	<b>CARMM</b>	Centre for Antarctic, Remote and Maritime Medicine
<b>APG</b>	Asia-Pacific Telecommunity Conference Preparatory Group	<b>CASA</b>	Civil Aviation Safety Authority
<b>APRSAF</b>	Asia-Pacific Regional Space Agency Forum	<b>CCEO</b>	CSIRO Centre for Earth Observation
<b>APT</b>	Asia-Pacific Telecommunity	<b>CDSCC</b>	Canberra Deep Space Communication Complex
<b>AsA</b>	Airservices Australia	<b>CEOS</b>	Committee on Earth Observation Satellites
<b>ASAM</b>	Australasian Society of Aero-space Medicine	<b>CFICC</b>	Counter Foreign Interference Coordination Centre
<b>ASDAF</b>	Australian Space Data Analysis Facility	<b>CHORUS</b>	Compact Hybrid Optical-RF User Segment
<b>ASDC</b>	Australian Space Discovery Centre	<b>CIC</b>	Critical Infrastructure Centre
<b>ASEAN</b>	Association of Southeast Asian Nations		



<b>CIPMA</b>	Critical infrastructure Program for Modelling and Analysis	<b>DFMC</b>	Dual-Frequency, Multi-Constellation
<b>CI-SONS</b>	Critical Infrastructure-Systems of National Significance	<b>DINGO</b>	Drilling, Inference, and Navigation for Geological Operations
<b>CLPS</b>	Commercial Lunar Payload Services	<b>DISER</b>	Department of Industry, Science, Energy and Resources
<b>CNES</b>	Centre National d'Etudes Spatiales (National Centre for Space Studies-French space agency)	<b>DIH</b>	Defence Industry Hub
<b>CNS</b>	Communication and Navigation System	<b>DIT</b>	Department of Industry and Trade (UK)
<b>COMNAP</b>	Council of Managers of National Antarctic Programs	<b>DITRDC</b>	Department of Infrastructure, Transport, Regional Development and Communications
<b>COSMIC-2</b>	Cosmic Observing System for Meteorology, Ionosphere and Climate-2	<b>DLR</b>	Deutsches Zentrum für Luft und Raumfahrt (German Aerospace Center)
<b>COSPAR</b>	Committee on Space Research	<b>DMTC</b>	Defence Materials Technology Centre
<b>COSPAR-K</b>	Committee on Space Research - Kids	<b>DORIS</b>	Doppler Orbitography and Radiopositioning Integrated by Satellite
<b>COSPac</b>	Climate and Oceans Support Program in the Pacific	<b>DSN</b>	Deep Space Network
<b>COSPAS- SARSAT</b>	International search and rescue satellite system. COSPAS: Russian acronym for “space system for the search of vessels in distress”; SARSAT: Search and Rescue Satellite	<b>DSS</b>	Deep Space Station
<b>COTS</b>	Commercial Off-the-Shelf	<b>DSTG</b>	Defence Science and Technology Group
<b>COVID-19</b>	Coronavirus Disease 2019	<b>EASI</b>	Earth Analytics Science and Innovation
<b>CRC</b>	Cooperative Research Centre	<b>EBVS</b>	Event Based Vision Sensors
<b>CRS</b>	Commercial Resupply Service (SpaceX)	<b>EC</b>	European Commission
<b>CSA</b>	Canadian Space Agency	<b>EO</b>	Earth Observation
<b>CSIG</b>	Cross Sectoral Interest Group	<b>EOA</b>	Earth Observation Australia
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation	<b>EOS</b>	Earth Observation from Space
<b>CSpO</b>	Combined Space Operations	<b>EROSS</b>	European Robotic Orbital Support Services
<b>DART</b>	Demonstration of Autonomous Rendezvous Technology	<b>ESA</b>	European Space Agency
<b>DAWE</b>	Department of Agriculture, Water and the Environment	<b>ESO</b>	European Southern Observatory
<b>DBNet</b>	Direct Broadcast Network for Near Real-Time Relay of Low Earth Orbit Satellite Data	<b>ET-SSU</b>	Expert Team on Space Systems and Utilisation
<b>DEA</b>	Digital Earth Australia	<b>EWS</b>	Emergency Warning Service
<b>DEAfrica</b>	Digital Earth Africa	<b>Five Eyes</b>	Intelligence alliance between Australia, Canada, New Zealand, UK, USA
<b>Defence</b>	Department of Defence	<b>FAST</b>	Fast Acting Space Transportation
<b>DFAT</b>	Department of Foreign Affairs and Trade	<b>FSP</b>	Future Science Platform
		<b>FTE</b>	Full-time Equivalent
		<b>FY</b>	Financial Year

<b>FYSO</b>	Five Year Spectrum Outlook	<b>INAF</b>	Istituto Nazionale di Astrofisica (National Astrophysics Institute)
<b>GA</b>	Geoscience Australia	<b>IOAG SOS</b>	Interagency Operations Advisory Group Space Operations Sustainability
<b>Galileo</b>	GNSS developed by the European Commission through ESA	<b>InSAR</b>	Interferometric Synthetic Aperture Radar
<b>GBAS</b>	Ground-based Augmentation System	<b>ISOC</b>	Inter-Spacecraft Omnidirectional optical Communicators
<b>GDP</b>	Gross Domestic Product	<b>IPT-SWElSS</b>	WMO Inter-Programme Team on Space Weather Information, Systems and Services
<b>GEO</b>	Group on Earth Observations; Geostationary Orbit	<b>ISECG</b>	International Space Exploration Co-ordination Group
<b>GEOGLAM</b>	Group on Earth Observations Global Agricultural Monitoring	<b>ISES</b>	International Space Environment Service
<b>GHRSSST</b>	Group for High Resolution Sea Surface Temperature	<b>ISI</b>	International Space Investment initiative
<b>GLOBE</b>	Global Learning and Observations to Benefit the Environment	<b>ISRO</b>	Indian Space Research Organisation
<b>GLONASS</b>	Russian acronym for “Global Navigation Satellite System”	<b>ISRU</b>	In-Situ Resource Utilisation
<b>GMDSS</b>	Global Maritime Distress and Safety System	<b>ISS</b>	International Space Station
<b>GNSS</b>	Global Navigation Satellite System	<b>ISWI</b>	International Space Weather Initiative
<b>GOES-R</b>	Geostationary Operational Environmental Satellite-R series	<b>ITU</b>	International Telecommunications Union
<b>GPM</b>	Global Precipitation Measurement Mission	<b>ITU-R</b>	ITU Radiocommunication Sector
<b>GPS</b>	Global Positioning System	<b>IVS</b>	International VLBI Service
<b>GSA</b>	European GNSS Agency	<b>JAXA</b>	Japan Aerospace Exploration Agency
<b>The Hub</b>	Defence Innovation Hub	<b>JEGHBM</b>	Joint Expert Group on Human Biology and Medicine
<b>Home Affairs</b>	Department of Home Affairs	<b>JPL</b>	Jet Propulsion Laboratory
<b>HSF</b>	Human Space Flight	<b>JPSS-2</b>	Joint Polar Satellite System
<b>IAB</b>	International Astronomy Branch	<b>KARI</b>	Korea Aerospace Research Institute
<b>IAC</b>	International Astronautical Congress	<b>Kibo-ABC</b>	Asian Beneficial Collaboration through "Kibo" Utilisation
<b>IALA</b>	International Association of Marine Aids to Navigation and Lighthouse Authorities	<b>Kibo-RPC</b>	Kibo Robot Programming Challenge
<b>IAU</b>	International Astronomical Union	<b>LAM</b>	Laboratoire d'Astrophysique de Marseille (Marseille Astrophysics Laboratory)
<b>ICAO</b>	International Civil Aviation Organisation	<b>LEO</b>	Low Earth Orbit
<b>ICSU-WDS</b>	International Science Council World Data System	<b>LGN</b>	Landsat Ground Network
<b>IEC</b>	International Electrotechnical Commission	<b>LINZ</b>	Land Information New Zealand
<b>IGS</b>	International GNSS Service	<b>LSC</b>	Legal Subcommittee (UNCOPUOS)
<b>ILRS</b>	International Laser Ranging Service	<b>M2M</b>	Moon to Mars
<b>IMEWG</b>	International Mars Exploration Working Group		
<b>IMO</b>	International Maritime Organisation		

<b>MADOCA</b>	Multi-GNSS Advanced Demonstration Tool for Orbit and Clock Analysis	<b>PG</b>	(Australian) Preparatory Group
<b>MAVIS</b>	MCAO Assisted Visible Imager and Spectrograph	<b>PIAG</b>	Pacific Island Advisory Group
<b>MCAO</b>	Multi-Conjugate Adaptive Optics	<b>PM&amp;C</b>	Department of the Prime Minister and Cabinet
<b>MCC</b>	Mission Control Centre	<b>PNT</b>	Position, Navigation and Timing
<b>MDBA</b>	Murray-Darling Basin Authority	<b>PNT-WG</b>	PNT Working Group
<b>METS</b>	Mining Equipment, Technology and Services	<b>QLD</b>	Queensland
<b>MMI</b>	Modern Manufacturing Initiative	<b>QZSS</b>	Quasi-Zenith Satellite System
<b>MMS</b>	Modern Manufacturing Strategy	<b>RAAF</b>	Royal Australian Air Force
<b>MOC</b>	Memorandum of Cooperation	<b>R&amp;D</b>	Research and Development
<b>MOU</b>	Memorandum of Understanding	<b>RMIT</b>	Royal Melbourne Institute of Technology
<b>MRO</b>	Murchison Radio-astronomy Observatory	<b>RSD</b>	Robotics Satellite Demonstration
<b>MSI</b>	Maritime Safety Information	<b>RSOC</b>	Responsive Space Operations Centre
<b>MWA</b>	Murchison Widefield Array	<b>RWC</b>	Regional Warning Centre
<b>NASA</b>	National Aeronautics and Space Administration	<b>S3VT-T</b>	Sentinel-3 Validation Team for Temperature
<b>NBN</b>	National Broadband Network; NBN Co Limited	<b>SACT</b>	Commercial Sprint Advanced Concept Training
<b>NCRIS</b>	National Collaborative Research Infrastructure Strategy	<b>SANSA</b>	South Africa National Space Agency
<b>NEA</b>	Near Earth Asteroid	<b>SAR</b>	Synthetic Aperture Radar; Search and Rescue
<b>NF</b>	Novel Florescence	<b>S&amp;T</b>	Science and Technology; State and Territory
<b>NGO</b>	Non-Governmental Organisation	<b>SATCOM</b>	Satellite Communications
<b>NMP</b>	National Manufacturing Priorities	<b>SBAS</b>	Satellite-based Augmentation System
<b>NNO</b>	New Norcia (WA)	<b>SBS</b>	Special Broadcasting Service
<b>NPIC</b>	National Positioning Infrastructure Capability	<b>SCAR</b>	Scientific Committee on Antarctic Research
<b>NRAR</b>	Natural Resources Access Regulator (NSW)	<b>SCC</b>	Australian Government Space Coordination Committee
<b>NSS</b>	National Simultaneous Storytime	<b>SCIFLI</b>	Scientifically Calibrated In-Flight Imagery
<b>NSS IDC</b>	National Security Space Inter-Departmental Committee	<b>SCR</b>	Satellite Cross-calibration Radiometer
<b>NSW</b>	New South Wales	<b>SEZ</b>	Space Edge Zero
<b>NT</b>	Northern Territory	<b>SDA</b>	Space Domain Awareness
<b>NZ</b>	New Zealand	<b>SG-RFC</b>	World Meteorological Organisation Steering Group on Radio Frequency Coordination
<b>O2O</b>	Optical to Orion	<b>SIAA</b>	Space Industry Association of Australia
<b>OAR</b>	Office of Airspace Regulation	<b>SIP</b>	Statutory Infrastructure Provider
<b>ODC</b>	Open Data Cube	<b>SIT</b>	Strategic Implementation Team
<b>OECD</b>	Organisation for Economic Cooperation and Development	<b>SKA</b>	Square Kilometre Array
<b>OGS</b>	Optical Ground Station		

<b>SKAO</b>	Square Kilometre Array Observatory	<b>UNSW</b>	University of New South Wales
<b>SLR</b>	Satellite Laser Ranging	<b>UNOOSA</b>	United Nations Office for Outer Space Affairs
<b>SME</b>	Small and Medium Enterprise	<b>UPRS</b>	Universal Payload Rack System
<b>SouthPAN</b>	Southern Positioning Augmentation Network	<b>US</b>	United States
<b>SpAARC</b>	Space Automation, Artificial Intelligence and Robotics Control Complex	<b>USG</b>	Universal Service Guarantee
<b>Space FSP</b>	Space Technology Future Science Platform	<b>USGS</b>	US Geological Survey
<b>SSA</b>	Space Situational Awareness	<b>USO</b>	Universal Service Obligation
<b>SSO</b>	Siding Spring Observatory	<b>UTAS</b>	University of Tasmania
<b>SSTL</b>	Surrey Satellite Technology Ltd	<b>VAST</b>	Viewer Access Satellite Television
<b>SST-VC</b>	CEOS Sea Surface Temperature Virtual Constellation	<b>VHF</b>	Very High Frequency
<b>STaR</b>	Science, Technology and Research	<b>VIC</b>	Victoria
<b>STSC</b>	Scientific and Technical Subcommittee (UNCOPUOS); State and Territory Space Coordination	<b>VIIRS</b>	Visible Infrared Imaging Radiometer Suite
<b>STEM</b>	Science, Technology, Engineering and Mathematics	<b>VLBI</b>	Very Long Baseline Interferometry
<b>SWS</b>	Space Weather Services	<b>VLT</b>	Very Large Telescope
<b>TARS</b>	Turn-Around Ranging Station	<b>WA</b>	Western Australia
<b>TAS</b>	Tasmania	<b>WGCV</b>	Working Group on Calibration and Validation
<b>TDRS</b>	Tracking and Data Relay Satellite	<b>WGISS</b>	Working Group on Information
<b>TERN</b>	Terrestrial Ecosystem Research Network	<b>WIGOS</b>	World Meteorological Organisation Integrated Global Observing System
<b>TIROS</b>	Television Infrared Observation Satellite	<b>WMO</b>	World Meteorological Organization
<b>TISN</b>	Trusted Information Sharing Network for Critical Infrastructure Resilience	<b>WDC</b>	World Data Centre
<b>TRISH</b>	Translational Research Institute for Space Health	<b>WRC</b>	World Radiocommunication Conference
<b>TOVS</b>	TIROS Operational Vertical Sounder		
<b>TSA</b>	Technology Safeguards Agreement		
<b>UAE</b>	United Arab Emirates		
<b>UAESA</b>	UAE Space Agency		
<b>UK</b>	United Kingdom		
<b>UKDIT</b>	UK Department for International Trade		
<b>UKSA</b>	United Kingdom Space Agency		
<b>UKSIN</b>	UK Science Innovation Network		
<b>UN</b>	United Nations		
<b>UNCOPUOS</b>	United Nations Committee on the Peaceful Uses of Outer Space		